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ABSTRACT

This combination workbook and set of tests contains materials on asphalt and wood shingling that have been designed to be used by those studying to enter the roofing and waterproofing trade. It consists of seven instructional units and seven accompanying objective tests. Covered in the individual units are the following topics: shingling materials, tools, and equipment; safety on shingling jobs; preliminary work; application of asphalt shingles in new construction; reroofing with asphalt shingles; application of roll roofing; and application of wood shingles and shakes. Each unit contains performance objectives, text, and a study assignment. Also included in the guide are lists of required and suggested instructional materials and a glossary. (MN)

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# Roofing

## Workbook and Tests

## Asphalt and Wood Shingling

Prepared by

***Arthur Brown***

Under the direction of the

**CALIFORNIA EDUCATIONAL ADVISORY COMMITTEE FOR THE ROOFING INDUSTRY**

and the

**BUREAU OF PUBLICATIONS, CALIFORNIA STATE DEPARTMENT OF EDUCATION**

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| | |
|---|---|
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California State Department of Education
721 Capitol Mall
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# Foreword

In the California apprenticeship programs, experience gained on the job is supplemented by classroom work that is closely related to the job. This balanced system of training enables the apprentice to learn the "why" as well as the "how" of the trade. Both types of training are required for advancement in today's competitive industries.

The job-related courses for the skilled trades are highly specialized, and adequate training materials are for the most part not available commercially. To meet this need, the Department of Education, in cooperation with labor and management, develops the required training materials and makes them available to you at cost. This workbook is an example. It was written to provide you with up-to-date information you must have to meet the growing technical demands of the roofing and waterproofing trade. Every effort has been made to make the workbook clear, comprehensive, and current.

I congratulate you on your choice of roofing and waterproofing as a career. The effort you put forth today to become a competent journey-level worker will bring you many rewards and satisfactions, and the benefits will extend also to your community. We need your skills and knowledge, and I wish you every success in your new venture.

*Superintendent of Public Instruction*

# Preface

The California State Department of Education, through the Bureau of Publications, provides for the development of instructional materials for apprentices under provisions of the California Apprentice Labor Standards Act. These materials are developed through the cooperative efforts of the Department of Education and employer-employee groups representing apprenticeable trades.

This edition of *Asphalt and Wood Shingling* was planned and prepared under the direction of the California Educational Advisory Committee for the Roofing Industry, with the cooperation of the State Joint Roofing Industries Apprenticeship Committee. The members of this committee include representatives of the Roofing Contractors Association of California and representatives of local unions. Employer representatives serving on the Educational Advisory Committee are Herman Little, San Jose (Chairman); Arthur Adams, San Carlos; and Robert Culbertson, Sacramento. Representing employees are Joe Guagliardo, Fresno; Oscar Padilla, Los Angeles; and William Penrose, San Jose. Special thanks and appreciation are extended to M. Duane Mongerson of Oakland, who served as Committee Adviser. The original copy for this publication was prepared by Arthur Brown, former Editorial Assistant, Bureau of Publications. Bob Klingensmith, Publications Consultant, Apprenticeship, directed publication activities for the Bureau of Publications.

This publication is one of a series of nine individually bound units of instruction for roofing apprenticeship classes. These books reflect the continuing cooperative effort of labor, management, local schools, and the Department of Education to provide the best instructional materials for California apprenticeship classes. They are dedicated to excellence in the training of roofing apprentices.

THEODORE R. SMITH
*Editor in Chief*
*Bureau of Publications*

# Acknowledgments

Gratitude is expressed to the following manufacturers and organizations that contributed valuable information, drawings, and photographs used in the preparation of this workbook:

Asphalt Roofing Manufacturers Association
Craftsman Book Company
National Roofing Contractors Association
Red Cedar Shingle and Handsplit Shake Bureau

# Asphalt and Wood Shingling

## TOPIC 1—SHINGLING MATERIALS, TOOLS, AND EQUIPMENT

This topic and the related instruction classes are designed to enable the apprentice to do the following:

- **Describe how asphalt shingles and mineral-surfaced roll roofing are made.**
- **Identify the common types and styles of asphalt shingles and mineral-surfaced roll roofing.**
- **Identify the various types and grades of wood shingles and shakes.**
- **Discuss the uses of felt underlayment in shingle roofing.**
- **Determine the best type and size of fastener to use for a given shingling or roll-roofing job.**
- **Describe the flashing materials used in shingle roofing.**
- **Distinguish among the common tools and equipment used in shingle roofing.**

In roofing, as in other phases of the highly competitive construction industry, the constant search for more efficient production methods has led to a certain amount of specialization. The general roofing contractor, who is equipped to bid on any kind or size of roofing or waterproofing job, is still the dominant figure in the trade. Some contractors, however, derive most of their income from built-up roofing jobs on large commercial, industrial, and public buildings, while others prefer to concentrate on residential work, which mainly involves the application of asphalt shingles, wood shingles, and wood shakes. Such specialization has some advantages, particularly with regard to high production, but it also has some disadvantages, especially for the roofer who is skilled in only one part of the trade. An overspecialized worker is usually more vulnerable to layoffs in slack times than one with broader knowledge and experience. For example, if market conditions bring about a temporary decline in new housing construction, a laid-off shingler with good all around roofing skills will usually be able to find work in commercial built-up roofing, residential reroofing, or general roofing repair. It is in a roofer's best interest to become proficient in all aspects of the trade.

### Shingling Materials

The basic materials used in shingle roofing are asphalt shingles, wood shingles, and wood shakes of various types and styles. Other materials, such as felt underlayment, metal flashing and edging, cements, sealants, and fasteners, are common items that are used throughout the roofing trade.

#### Asphalt Shingles

Asphalt shingles—also called composition shingles—are among the most popular types of roofing materials, both for new work and for reroofing jobs. They are manufactured in a wide range of styles, shapes, and colors, and they are adaptable to almost any kind of building with an adequately sloped roof, usually a slope of 4 inches in 12 inches (4/12 [10.2 centimetres in 30.5 centimetres]) or more, but sometimes as little as 2/12 for special low-slope installations. Asphalt shingles have good fire resistance, and if properly installed, they will not curl or buckle. The long life and relatively low initial cost of asphalt shingles make them an economical choice for most residential roofing and reroofing jobs.

Asphalt shingles consist mainly of a base mat (commonly organic felt or inorganic fiberglass), hot asphalt saturant and coatings, and mineral surfacing materials. In the manufacturing process base-mat material from a large roll is fed first through a tank of hot asphalt saturant and then into a cooling enclosure called a wet looper, where the penetration of the saturant is increased. From the wet looper the mat passes through rolls that apply top and bottom coatings of high-melt asphalt, which has been blended with a mineral stabilizer to improve the weather resistance and flexibility of the shingles. After leaving the asphalt-coating rolls, the mat is covered on the top with a

layer of colored rock granules and on the bottom with a light dusting of talc or mica. It is then passed through pressure rolls to embed the granules. The finished material is fed into a shingle-cutting machine, from which the shingles emerge ready for packaging. Mineral-surfaced roll roofing is made in basically the same way and often on the same production line, except that the shingle cutter is bypassed.

The most common type of asphalt shingle is the three-tab strip shingle. The tabs permit the shingles to conform more readily to slight irregularities in the roof surface, and they provide a pleasing architectural effect. Strip shingles and some other common types of asphalt shingles are illustrated and described in Table 1-1.

**Wood Shingles and Shakes**

Wood shingles and shakes are traditional roofing materials that have maintained their popularity over the years primarily because of their distinctive appearance. They are manufactured mainly from western red cedar, but cypress and redwood are also used. Wood shingles are sawn on both sides, with a smooth taper and uniform butt thickness. Wood shakes are usually thicker at the butt end than wood shingles, and most shakes have one or both surfaces hand split with a heavy chisel and a wooden mallet to provide a highly textured effect. The common hand-split and resawn shake has a split face and a sawn back; it is made from a board that has been split on both sides, then run diagonally through a bandsaw to produce two tapered shakes. (See Fig. 1-1.) Another popular type is the taper-split shake; it has a natural taper that is obtained by "cranking" the chisel, as shown in drawing No. 2 in Figure 1-1, and reversing the cedar block after each split. Straight-split or barn shakes are made in the same way as taper-split shakes, except that all the splitting is done from the same end of the block and with the chisel driven straight down, resulting in a shake with no taper.

Wood shingles and shakes are commonly available in 16-, 18-, and 24-inch (40.6-, 45.7-, and 61-centimetre) lengths and are bundled in random widths, usually 3 to 14 inches (7.6 to 35.6 centimetres) for shingles and 4 to 14 inches (10.2 to 35.6 centimetres) for shakes. A 15-inch-long (38.1-centimetre-long) shake is manufactured for use in starter or finish courses. Wood shingles of uniform width (dimension shingles) are also available at extra cost.

Cedar shingles are graded No. 1, 2, 3, or 4 in accordance with their quality and intended use. No. 1 is the premium grade, made of 100-percent clear, edge-grain heartwood; No. 2 is a good grade that permits some sapwood and flat grain; No. 3 is a utility grade intended for secondary buildings and other economy applications; and No. 4 is a utility grade used mainly for undercoursing. Cedar shakes are available only in premium (No. 1) grade. (See Table 1-2.)

More detailed information about wood shingles and shakes will be found in industry publications, such as *Red Cedar Shingles and Shakes*, a brochure published by the Red Cedar Shingle and Handsplit Shake Bureau, Bellevue, Washington. (See the Instructional Materials Section on page 50 of this workbook.)

**Felt Underlayment**

One course of No. 15 unperforated roofing felt is commonly used as an underlayment for new asphalt shingles. The felt acts as an additional water barrier in the event that a loose shingle lifts in a violent storm, and it helps prevent buckling of the shingles by ensuring that they will have a dry base during installation. It also keeps the shingles from contacting and being softened by any pitch or resin that might be present on the wood deck.

Felt is usually not required when new asphalt shingles are applied over an existing roof with a pitch of 4/12 or more, since the old roofing material can serve as an underlayment if it is not excessively weathered. If the old roof must come off down to the sheathing, however, felt will be needed under the new shingles. Felt underlayment is usually optional between wood shingles and the sheathing, but interwoven strips of No. 30 felt are required between courses of wood shakes.

Local building codes may contain other requirements regarding felt underlayment, especially in areas where winters are severe.

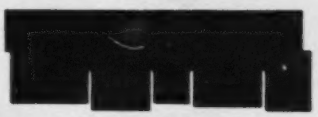
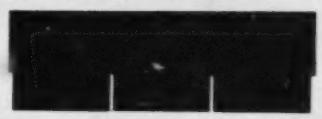
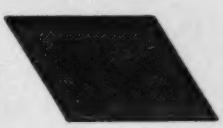
**Fasteners**

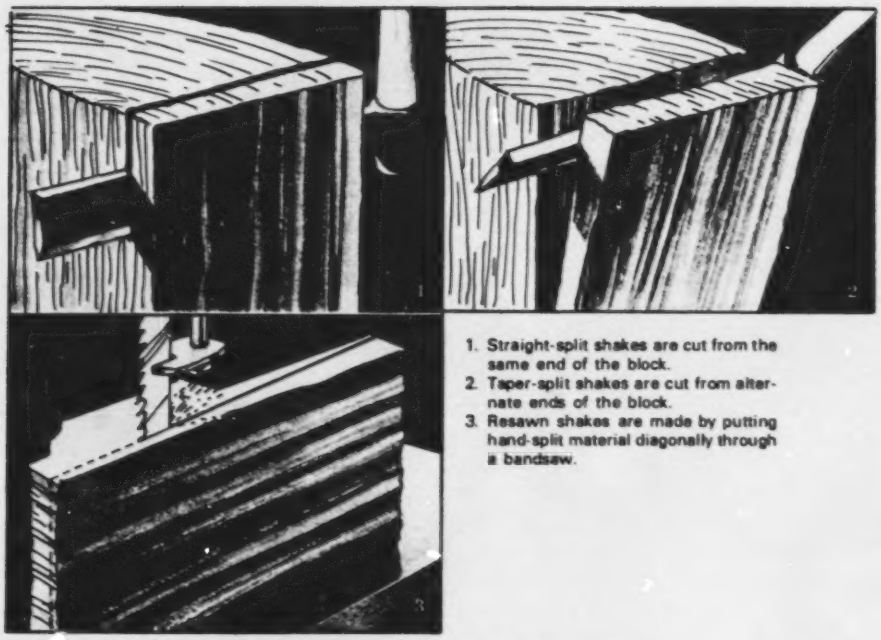
The fasteners most often specified for shingle roofing and reroofing are galvanized-steel, aluminum, or stainless-steel roofing nails. Power-driven staples are also gaining acceptance, particularly for new composition roofs. Plain steel or blued steel nails are vulnerable to rust and corrosion and should not be used. The zinc coating on the galvanized-steel nails not only provides rust resistance but also increases the holding power of the fasteners. Where even greater holding power is desired, as in shingling on a plywood deck, roofing nails with deformed shanks (barbed- or annular-ring nails) are the best choice.

Roofing nails have large heads (⅜ to ½ inch [1 to 1.3 centimetres] in diameter) to help prevent materials' tearing out. Nails for asphalt shingle roofs are usually 11 or 12 gage; those for wood shingles and shakes are smaller in diameter (13 to 14½ gage). Roofing nails range in length from ¾ inch (1.9 centimetres), used mainly for roll roofing on new decks, to 2½ inches (6.4 centimetres). The lengths most often used

TABLE 1-1

**Typical Asphalt Shingles and Specifications**

| PRODUCT | Configuration | Per Square | | | Size | | Exposure | Underwriters Laboratories Listing |
|---|---|---|---|---|---|---|---|---|
| | | Approximate Shipping Weight | Shingles | Bundles | Width | Length | | |
| Self-sealing random-tab strip shingle Multi-thickness | Various edge, surface texture and application treatments | 285# to 390# | 66 to 90 | 4 or 5 | 11½" to 14" | 36" to 40" | 4" to 6" | A or C - Many wind resistant |
| Self-sealing random-tab strip shingle  Single-thickness | Various edge, surface texture and application treatments | 250# to 300# | 66 to 80 | 3 or 4 | 12" to 13¼" | 36" to 40" | 5" to 5⅝" | A or C - Many wind resistant |
| Self-sealing square-tab strip shingle  Three-tab | Two-tab or Four-tab | 215# to 325# | 66 to 80 | 3 or 4 | 12" to 13¼" | 36" to 40" | 5" to 5⅝" | A or C - All wind resistant |
| | Three-tab | 215# to 300# | 66 to 80 | 3 or 4 | 12" to 13¼" | 36" to 40" | 5" to 5⅝" | |
| Self-sealing square-tab strip shingle No-cutout | Various edge and surface texture treatments | 215# to 290# | 66 to 81 | 3 or 4 | 12" to 13¼" | 36" to 40" | 5" to 5⅝" | A or C - All wind resistant |
| Angolap  | Rectangular | 150# to 175# | 96 | 2 or 3 | 12" | 18" | 10" | C |



1. Straight-split shakes are cut from the same end of the block.
2. Taper-split shakes are cut from alternate ends of the block.
3. Resawn shakes are made by putting hand-split material diagonally through a bandsaw.

**Fig. 1-1. Methods of producing wood shakes**

TABLE 1-2

**Wood Shingles and Shakes**

| GRADE | Length | Thickness (at Butt) | No. of Courses Per Bundle | Bdls/Cartons Per Square | Description |
|---|---|---|---|---|---|
| No. 1 | 16" (Fivex)<br>18" (Perfections)<br>24" (Royals) | .40"<br>.45"<br>.50" | 20/20<br>18/18<br>13/14 | 4 bdls<br>4 bdls<br>4 bdls | The premium grade of shingles for roofs and sidewalls. These top-grade shingles are 100% heartwood, 100% clear and 100% edge-grain. |
| No. 2 | 16" (Fivex)<br>18" (Perfections)<br>24" (Royals) | .40"<br>.45"<br>.50" | 20/20<br>18/18<br>13/14 | 4 bdls<br>4 bdls<br>4 bdls | A good grade for many applications. Not less than 10" clear on 16" shingles, 11" clear on 18" shingles and 16" clear on 24" shingles. Flat grain and limited sapwood are permitted in this grade. |
| No. 3 | 16" (Fivex)<br>18" (Perfections)<br>24" (Royals) | .40"<br>.45"<br>.50" | 20/20<br>18/18<br>13/14 | 4 bdls<br>4 bdls<br>4 bdls | A utility grade for economy applications and secondary building. Not less than 6" clear on 16" and 18" shingles, 10" clear on 24" shingles. |
| No. 4 | 16" (Fivex)<br>18" (Perfections) | .40"<br>.45" | 14/14 or 20/20<br>14/14 or 18/18 | 2 bdls 2 bdls<br>2 bdls 2 bdls | A utility grade for undercoursing on double-coursed sidewall applications or for interior accent walls. |
| No. 1 or No. 2 | 16" (Fivex)<br>18" (Perfections)<br>24" (Royals) | .40"<br>.45"<br>.50" | 33/33<br>28/28<br>13/14 | 1 carton<br>1 carton<br>4 bdls | Same specifications as above for No. 1 and No. 2 grades but machine trimmed for exactly parallel edges with butts sawn at precise right angles. For sidewall application where tightly fitting joints are desired. Also available with smooth sanded face. |

*NOTE:* All weights and dimensions are approximate.

*(continued)*

*NOTE:* Quality standards for wood shingles and shakes change as building codes (local codes, *Uniform Building Code*, and so on) are updated. Be sure to check applicable codes for current standards.

TABLE 1-2 (continued)

| GRADE | Length and Thickness | 18" Pack** | | Description |
|---|---|---|---|---|
| | | #Courses Per Bdl. | #Bdls. Per Sq. | |
| No. 1 HANDSPLIT & RESAWN | 15" Starter-Finish | 9/9 | 5 | These shakes have split faces and sawn backs. Cedar logs are first cut into desired lengths. Blanks or boards of proper thickness are split and then run diagonally through a bandsaw to produce two tapered shakes from each blank. |
| | 18" × ½" Mediums | 9/9 | 5 | |
| | 18" × ¾" Heavies | 9/9 | 5 | |
| | 24" × ⅜" | 9/9 | 5 | |
| | 24" × ½" Mediums | 9/9 | 5 | |
| | 24" × ¾" Heavies | 9/9 | 5 | |
| No. 1 TAPERSPLIT | 24" × ½" | 9/9 | 5 | Produced largely by hand, using a sharp-bladed steel froe and a wooden mallet. The natural shingle-like taper is achieved by reversing the block, end-for-end, with each split. |
| | | 20" Pack | | |
| No. 1 STRAIGHT-SPLIT | 18" × ⅜" True-Edge* | 14 Straight | 4 | Produced in the same manner as tapersplit shakes except that by splitting from the same end of the block, the shakes acquire the same thickness throughout. |
| | 18" × ⅜" | 19 Straight | 5 | |
| | 24" × ⅜" | 16 Straight | 5 | |

NOTE: *Exclusively sidewall product, with parallel edges. **Pack used for majority of shakes.

*NOTE:* All weights and dimensions are approximate.

*NOTE:* Quality standards for wood shingles and shakes change as building codes (local codes, *Uniform Building Code*, and so on) are updated. Be sure to check applicable codes for current standards.

for new composition roofs and wood-shingle roofs are 1 inch and 1½ inches (2.5 and 3.8 centimetres); longer nails are used mainly at hips and ridges and for applying wood shakes. Most roofing specifications require that the nails used must be long enough to penetrate at least ¾ inch (1.9 centimetres) into lumber sheathing or through plywood decking.

Roofing nails should be driven just hard enough so that the underside of the head is tight against the top surface of the shingle but not so hard that they cut into or crush the shingle. The type, size, and quantity of roofing nails to use in various shingling applications are normally specified by the shingle manufacturer. Three-tab strip shingles are usually fastened with four nails, one centered above each cutout and one set in 1 inch (2.5 centimetres) from each side. In windy areas, however, the roofing specifications may call for six nails per shingle. The nails should be on a line about ⅝ inch (1.6 centimetres) above the cutouts so that they will penetrate the shingle below. Wood shingles and shakes are fastened with only two nails, which are located ¾ inch (1.9 centimetres) from each side of the shingle (1 inch [2.5 centimetres] for shakes) and high enough to be covered by the next course.

### Flashing Materials and Metal Edging

Flashing is used to make a roof weathertight at valleys, ridges, eaves, and intersections with vertical walls; around chimneys, skylights, and other projections; and wherever an abrupt change of direction occurs in the roof. Most of the flashing materials used in other kinds of roofing are appropriate for composition roofing and wood-shingle roofing. Common flashing materials for shingle roofs are asphalt felt, mineral-surfaced roll roofing, galvanized metal, and aluminum. Sheet copper, lead, and vinyl flashings are also used, but to a lesser extent.

Nailing through flashing should be kept to a minimum, and the roofing-material manufacturer's instructions regarding nailing locations on flashings should be followed. Splices in flashings should also be avoided if possible, particularly in valleys. An unbroken run of valley flashing is best, but if a splice is unavoidable, it must be carefully fitted and adequately lapped. The lap should be sealed with plastic asphalt cement, especially if the flashing material is roll roofing.

Roofing nails that will be in contact with metal flashing must be compatible with the flashing material to avoid corrosion from electrolytic action. Aluminum nails should be used with aluminum flashing, galvanized nails with galvanized-metal flashing, and copper nails with copper flashing. Any roofing nail may be used satisfactorily with lead flashing, since lead is not chemically reactive.

Metal drip edging is used along the eaves and rakes of a shingle roof or a roll-roofing roof to allow water runoff to drip free of the deck edge and to provide a finished appearance. Most preformed metal edging is made of galvanized metal, but copper and aluminum are also used.

### Roll Roofing

Mineral-surfaced roll roofing and asphalt shingles are closely related products with similar characteristics and uses. For this reason a topic on roll roofing is included in this workbook (Topic 6). Roll roofing makes a practical and weathertight roof where low cost and ease of installation are more important than appearance. An advantage of roll roofing is that it can be used on very low-sloped roofs (as low as 1/12).

Mineral-surfaced roll roofing is manufactured with an organic felt or inorganic fiberglass base mat, in rolls 36 inches (91.4 centimetres) wide and approximately 36 feet (11 metres) long, and in various weights. Colored mineral granules are embedded in the top surface of the mat, as in asphalt shingles. The granule coating may extend across the full width of the mat, or it may stop short of the full width to provide a smooth selvage edge for lapping the next course. A common type of roll roofing, called split sheet, has a 19-inch (48.3-centimetre) selvage edge and 17-inch (43.2-centimetre) exposure (the mineral-surfaced part that will be exposed to the weather). This is also called double-coverage roofing, since it produces a two-ply roof when lapped the full 19-inch (48.3-centimetre) width of the selvage edge. Other types of roll roofing have 2- or 4-inch (5.1- or 10.2-centimetre) selvage edges. Roll roofing is also manufactured without the mineral-granule coating; this material is used mainly as an underply in built-up roofing systems.

One roll of mineral-surfaced roll roofing normally contains 108 square feet (10 square metres) of material and when installed covers 100 square feet (9.3 square metres) of roof area. The remaining 8 square feet (0.7 square metre) are included for lapping. A roll of split sheet, double-coverage roofing material contains 108 square feet (10 square metres), but because of the wide overlap, it covers only half a square of roof area (50 square feet [4.6 square metres]). Some typical asphalt roll-roofing products are illustrated and described in Table 1-3.

### Shingling Tools and Equipment

Most of the small tools required for applying asphalt shingles, roll roofing, and wood shingles and shakes are common items that are used throughout the roofing trade: utility knives, pry bars, tin snips, chalk lines, tape measures, handsaws, ripper bars, and hammers. Hip pads and knee pads should be worn on steep roofs to increase traction and reduce fatigue.

A shingler must have an ample supply of roofing nails within easy reach to keep the job moving at a steady pace. Most shinglers wear a nail pouch or a "nail stripper" (see Fig. 1-2), from which they take nails as they need them. The pouch or stripper is refilled from a reserve supply in a nail bag suspended from the shingler's tool belt.

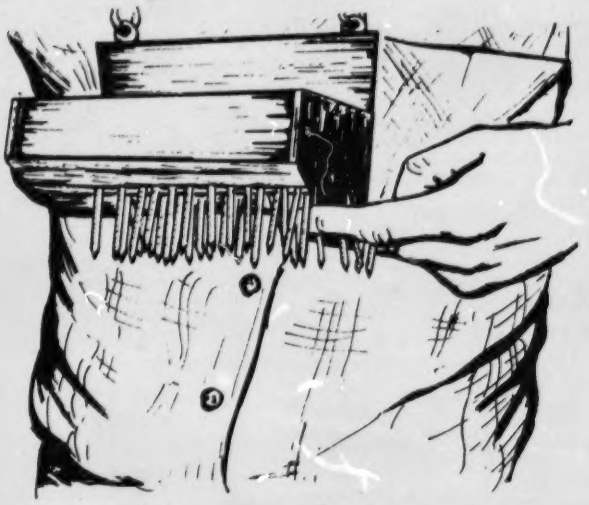


Fig. 1-2. Nail stripper

An indispensable and nearly all-purpose tool is the roofing hatchet (see Fig. 1-3). It is used not only to trim and split wood shingles and shakes but also to drive roofing nails, open the cutouts on T-lock composition shingles, and gage the weather exposure on all types of shingles. The blade is ground and sharpened on the bottom and front edges for added convenience in trimming and splitting. The blades of some roofing hatchets are drilled at several locations along the top edge to permit attachment of a shingle-exposure gage, or a sliding adjustable gage may be provided that clips over the top edge of the blade.

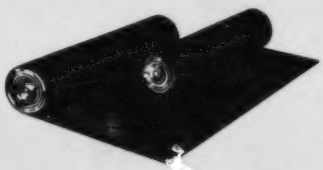
The major items of equipment needed on shingling and roll-roofing jobs are ladders and scaffolds, ladder loaders, A-frame hoists, roof jacks and planks, chicken ladders, safety lines, and rope for handlines. These and other items used in shingle roofing and roll roofing are described in *Entering the Roofing and Waterproofing Industry* and in various publications within the roofing industry. (See the Instructional Materials section on page 50 of this workbook.) Additional information on safety-related equipment, such as ladders, scaffolds, roof jacks, and proper clothing for the roofer, is presented in Topic 2.

### Study Assignments

1. *Entering the Roofing and Waterproofing Industry.* Sacramento: California State Department of Education, 1980. Review the material on hand tools, power tools, and wood shingles.

TABLE 1-3

**Typical Asphalt Rolls and Specifications**

| PRODUCT | Approximate Shipping Weight | | Squares Per Package | Length | Width | Side or End Lap | Top Lap | Exposure | Underwriters Laboratories Listing* |
|---|---|---|---|---|---|---|---|---|---|
| | Per Roll | Per Square | | | | | | | |
| Mineral surface roll | 75# to 90# | 75# to 90# | 1 | 36' to 38' | 36" | 6" | 2" to 4" | 32" to 34" | C |
| | Available in some areas in 9/10 or 3/4 square rolls. | | | | | | | | |
|  Mineral surface roll (double coverage) | 55# to 70# | 110 # to 140 # | ½ | 36' | 36" | 6" | 19" | 17" | C |
| Smooth surface roll | 40# to 65# | 40# to 65# | 1 | 36' | 36" | 6" | 2" | 34" | None |
| Saturated felt (non-perforated) | 60# | 15# to 30# | 2 to 4 | 72' to 144' | 36" | 4" to 6" | 2" to 19" | 17" to 34" | None |

*UL rating at time of publication. Reference should be made to individual manufacturer's product at time of purchase.

2. *Common Roofing and Waterproofing Materials and Equipment.* Sacramento: California State Department of Education, 1982. Review the information on asphalt and wood shingles, mineral-surfaced roll roofing, flashing materials, felt underlayment, and fasteners.

3. Examine industry brochures, manuals, and sales literature pertaining to asphalt shingles, wood shingles and shakes, and shingling tools and equipment. Some suggested sources of this information are listed in the Instructional Materials section on page 50 of this workbook.

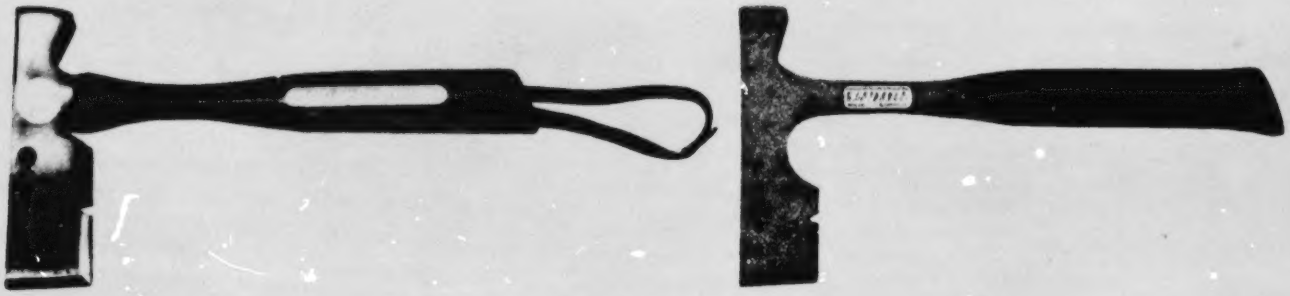


**Fig. 1-3. Roofing hatchets**

## ASPHALT AND WOOD SHINGLING

## TOPIC 2—SAFETY ON SHINGLING JOBS

This topic and the related instruction classes are designed to enable the apprentice to do the following:

- **State the cardinal rule for safety in "high work."**
- **Inspect the roof structure before starting a shingling job to ensure that it is strong enough to bear the weight of the roofers and the roofing materials.**
- **Describe the safe ways to climb or traverse a steep roof.**
- **Avoid slipping or falling on a steep roof.**
- **Discuss the uses of roof jacks, ladder jacks, scaffolds, boatswain's chairs, and slings as safety aids in shingling.**

### Basic Safety Rules for Shinglers

Working high off the ground is an essential part of the roofing trade. A person who is new to the trade may feel some uneasiness about working at heights, especially if the roof has a steep pitch, but an experienced roofer knows that "high work" need not be dangerous if the appropriate safety rules are followed. The cardinal rule for all high work is: *Keep your mind on the job—if you let your attention wander, you will be in danger!*

Here are some other safety rules that every shingler must know and heed:

- Even if you are accustomed to working at heights, stay off the roof if you are not feeling well. Your own safety and the safety of your co-workers require that you be alert and free of any distractions that could keep you from giving full attention to the job. (Remember the cardinal rule!)
- Never attempt to work on a steep roof unless you have the proper safety equipment and know how to use it. Also, avoid working alone on a steep roof.
- If possible, avoid working on a wet roof. If you must make emergency repairs to a roof in wet weather, be sure that needed safety equipment is in place, and take extra care to avoid slips and falls.
- Stay off the roof if a summer storm threatens. You could become a human lightning rod!
- Wear proper shoes. Gripper-type rubber-soled shoes or the equivalent are acceptable for shingling on a steep roof. Wearing shoes with leather soles and heels is a dangerous practice on any shingling job, and it is extremely hazardous on a dry wood shingle roof, regardless of the pitch of the roof.
- Before beginning a shingling job, inspect the roof structure to ensure that it is strong enough to support your weight, the weight of other workers, and that of the roofing materials. On older houses give special attention to canopies, cornices, rakes, and eaves, since these parts of the roof may have become weakened from long exposure to the weather and resulting dry rot.
- On reroofing or repair jobs, beware of loose or deteriorated shingles; they can give way suddenly under your weight and cause a bad fall. The chance of slipping will be much reduced if handlines, chicken ladders, and other required safety items are in place and are being used.
- Stack roofing materials away from the edges of the roof, and keep the work area clear of debris.
- Make sure ladders and scaffolds are approved types, in good condition, and properly placed and tied. Ladders should be inclined 1 foot (30.5 centimetres) out from the wall at the base for every 4 feet (1.2 metres) of height. A ladder placed against an eave to permit access to the roof should extend 3 feet (91.4 centimetres) above the eave line. Do not depend on an eave gutter to support the top of the ladder.
- Be careful to avoid contact with the electrical service conductors that come from utility poles. This is especially important in tear-off and reroofing operations on older houses. The weathered insulation on old wires may not be adequate to protect you from electrical shock, particularly in wet weather. Keep metal ladders away from electrical wires. Also, keep in mind that television antennas, air conditioners, ventilator fans, and other roof-mounted electrical equipment can present a shock hazard. If possible, shut off power to these items before starting the job, or have an electrician check them.

- When climbing a steep roof, put your foot fully down on the roof and stand erect. If you lean forward toward the peak of the roof, your heels will tend to lift, and this will reduce your traction by at least one-half. When walking across the slope of a roof, always secure good footing with the down-slope foot (it carries most of your weight), and keep the other foot ready in case of a slip.
- If you should fall on a steep roof, lie flat with your arms and legs outstretched; this position provides maximum resistance to slipping and rolling.

## Work on a Steep Roof

What pitch makes a roof a steep roof? No single answer to that question would be universally acceptable, since a roofer's feelings about steepness can be affected by many variables—the weather, for example, or the height, type, or condition of the roof. As a general rule a roof with a pitch greater than 1/3 (or a slope of 8/12) is considered too steep to walk on, but a roof with considerably less pitch may also be dangerous if it is covered with dust, moss, or any other substance that could act as a lubricant and reduce traction. Also, any roof—regardless of its pitch—can be considered dangerous to walk or work on if the required safety items are not in place. The CAL/OSHA requirements for roofing safety equipment are set forth in the California *Construction Safety Orders,* Article 30.

### Chicken Ladders

A chicken ladder, or cleat ladder as it is sometimes called, is often used on steep roofs as a safety device for walking and as a means of protecting the roof surface against damage from foot traffic. Chicken ladders are usually made by clinch-nailing wooden cleats at about 12-inch (30.5-centimetre) intervals on a 15- or 20-foot (4.6- or 6.1-metre) plank. At one end of the plank, on the side opposite the cleats, is nailed a short piece of 2 x 4 (5.1 x 10.2 centimetre) or 4 x 4 (10.2 x 10.2 centimetre) lumber that serves as a ridge hook to hold the ladder in place on the roof. (See Fig. 2-1.) Another type of chicken ladder is simply a length of factory-made ladder to which a metal hook is attached at one end. The hook is equipped with a swivel plate that keeps it from digging into asphalt roofing. (See Fig. 2-2.) A chicken ladder is placed in position by sliding it up the roof from the eave until the ridge hook drops over the ridge, then giving it a slight downward pull. (CAUTION: Before a chicken ladder is used, it should be tested by pulling on it as hard as possible two or three times.)

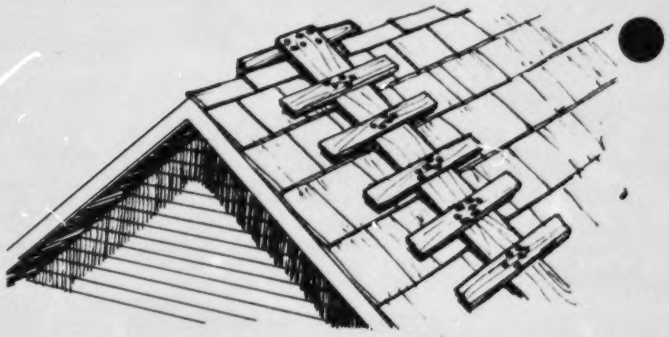


Fig. 2-1. A typical job-built chicken ladder

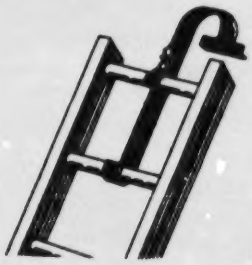


Fig. 2-2. A ladder section fitted with a ridge hook

### Roof Jacks and Ladder Jacks

When applying shingles on a steep roof, a roofer begins by nailing the first two courses in place while standing on a plank that is supported by two ladders equipped with ladder jacks. Next, the roofer nails in place two roof jacks (also called roof brackets) not more than 10 feet (3 metres) apart and in such a position that they do not interfere with the next course of roofing material. The roof jacks must be securely anchored; if possible, they should be nailed into rafters. A plank of at least 2 x 6 (5.1 x 15.2 centimetres) straight-grained lumber is then placed on the jacks to serve as a safe platform from which the roofer will work. (See Fig. 2-3.) Kneeling or sitting on the plank, the roofer shingles up to a convenient height, then nails on another set of jacks and continues the process until reaching the ridge. When the job is finished, the roofer removes the jacks with a slight push upwards and sideways, starting from the top set and working down. Next, the roofer must lift the tabs of the shingles where the jacks were nailed and drive the protruding nails down. *NOTE:* For the safety of others below, it is recommended that a row of jacks be placed at the eave line to help prevent tools, materials, and so forth from sliding down and off the roof.

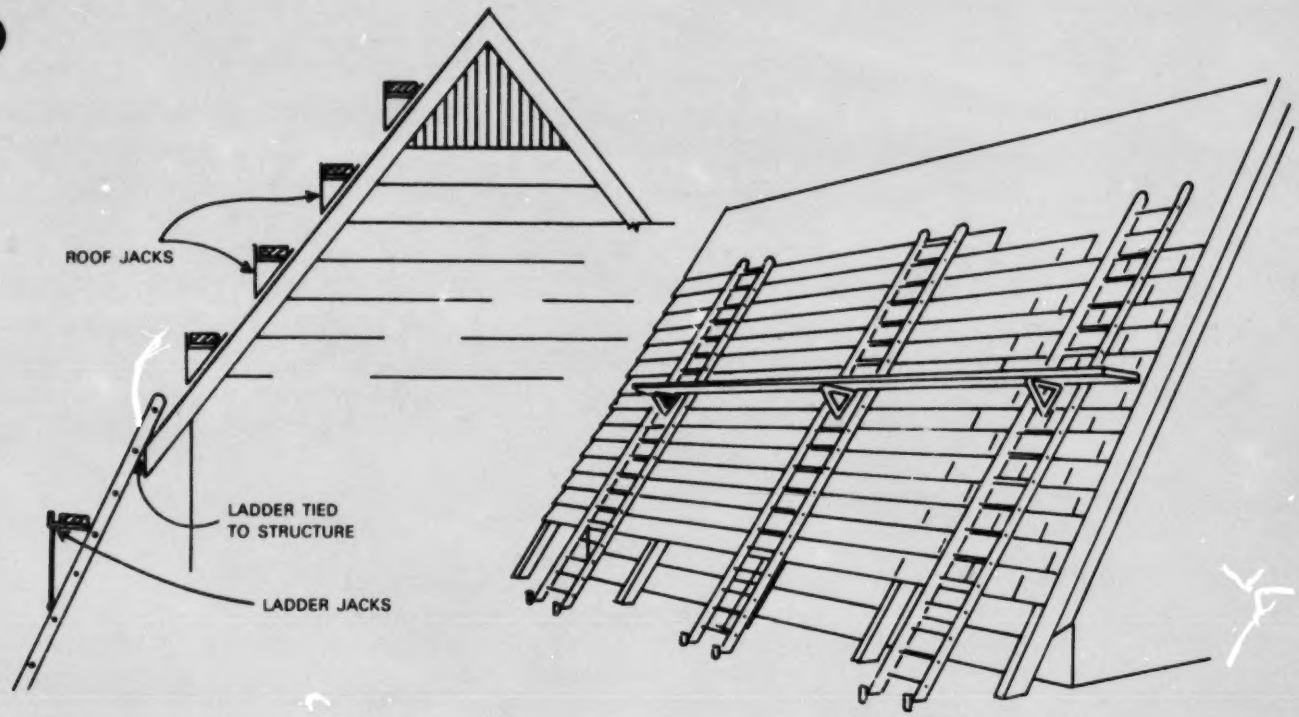



**Fig. 2-3. Typical placement of ladder jacks and roof jacks**

Safety requirements for roof jacks can be found in the California *Construction Safety Orders,* Article 30, Section 1724(a).

**Scaffolds**

Scaffolding may have to be installed on a job that involves shingling a spire or other roof surface that is too steep to accommodate roof jacks. When scaffolding is needed in new construction, it is usually erected by the general contractor. On repair or recover jobs, it may be supplied and installed by a scaffolding company. Minor repair work on spires and other extremely steep surfaces is sometimes done from a boatswain's chair when no other method of access is possible. Also, a sling may be used for some traversing on such nearly vertical surfaces. All rigging associated with scaffolds, boatswain's chairs, and slings must be securely anchored and must conform to the requirements set forth in the California *Construction Safety Orders.*

## Study Assignments

1. *Entering the Roofing and Waterproofing Industry.* Review Topic 5, "Safety in the Industry."
2. *Construction Safety Orders* (Latest edition). San Francisco: California State Department of Industrial Relations, Division of Industrial Safety. Review the requirements for railings, runways, scaffolds, planks, safety belts and lines, and ladders in articles 16, 17, and 21—25. In Article 30, read sections 1724 (roofing, general) and 1730 (hazards).

## ASPHALT AND WOOD SHINGLING

## TOPIC 3—PRELIMINARY WORK

This topic and the related instruction classes are designed to enable the apprentice to do the following:

- **Inspect a new or old roof to make sure it is structurally sound and ready for shingling.**
- **Describe some defects in a new deck that could interfere with production of a quality shingling job.**
- **On a reroofing job determine the kind and amount of preliminary work that must be done to ensure quality shingling.**
- **Inspect ladders, scaffolds, and ladder loaders used on the job to make sure they are safe.**
- **Identify the safest and most convenient locations for loading bundles of shingles on a roof.**

### Inspection of the Roof Structure

Before starting a shingling job, the roofing contractor should inspect the entire roof structure to make sure it is safe to work on and in satisfactory condition to receive the roofing materials. The inspection should include the roof framing as well as the deck. If the underlying structure is not sound, the deck will be unstable, and this can be the source of many kinds of roofing problems. In new work any defects that are revealed during the inspection should be brought to the attention of the general contractor or builder for correction. On a recover job one or more layers of the existing roof may have to be torn off, or the existing roof may require spot repairs or an overlay before it can serve as an acceptable base for the new shingles. Also, the sheathing, the supporting framing, or the exterior trim may be in need of repair. The roofing contractor should inform the owner about any problems of this kind and explain why the additional preliminary work is necessary for a quality shingling job.

All needed materials, tools, and equipment should be on hand at the jobsite before the shingling job is begun. Ladders, ladder loaders, and scaffolds must be in good condition, properly placed on a good bearing surface, and securely anchored. The pitch of the roof should be determined so that appropriate safety measures can be planned. (See the *Construction Safety Orders,* Section 1730.) On a new job the pitch can be found in the blueprints, or it can be checked with a spirit level and a tape rule. The location of rafters and braces should also be known for maximum safety in loading and walking on the deck; this is especially important in reroofing an older building. If the blueprints for a new building include a roof plan, the layout of the rafters may be shown there.

### Preliminary Work on New Roofs

On a new job the roofing contractor should make sure that all construction work on the roof deck has been completed in a satisfactory manner before sending a shingling crew to the jobsite. The lumber sheathing or plywood decking should be inspected for weak spots, incorrect or insufficient nailing, inadequate support, and poor fit at gables and eaves and around chimneys, vents, and other projections. Pipes and vents that extend through the roof should be securely anchored. Sheathing lumber should not be warped or split, and it should have no large knotholes. Any holes with loose knots should be covered with sheet metal. Plywood sheathing panels should be installed with the face grain at right angles to the rafters and with the end joints staggered. Panel joints should show little or no movement with normal deck loads. If a joint is not supported by framing members, it should be blocked or clipped to prevent movement. (Tongue-and-groove joints usually do not require blocking.) Adjoining plywood panels should not be tightly butted or spaced too far apart; clearances of about $\frac{1}{16}$ inch (0.2 centimetre) at end joints and $\frac{1}{8}$ inch (0.3 centimetre) at side joints are usually considered acceptable. The lumber or plywood deck should be dry and swept clean before the felt underlayment or shingles are applied, and the space beneath the deck should have proper ventilation to prevent moisture from condensing on the underside of the sheathing. *NOTE:* Before beginning to apply the roofing materials, the roofer should make sure that all necessary flashing, jacks, and gravel stops are on the jobsite.

### Preliminary Work on Reroofing Jobs

The first step in planning a reroofing job with asphalt or wood shingles is to determine whether par-

tial or complete tear-off of the old roof is required. Local building codes usually prohibit reroofing over more than two existing roofs. If the old roofing is badly deteriorated, or if the sheathing or framing is in need of repair, all the old roof coverings may have to be removed; otherwise, partial tear-off to meet local code requirements may be all that is necessary.

If tear-off is required, the crew should start at the ridge and work down, letting all the old roofing material fall to a place where it can conveniently be picked up and where it does not interfere with foot or vehicular traffic. Starting the tear-off from the high point of the roof keeps debris out of the work area and prevents it from falling through exposed spaced sheathing into the attic. The building's exterior and nearby trees, shrubs, and the like should be protected from falling material, and the building occupants and others in the vicinity should be warned about the hazard. Piled debris should be removed from the jobsite as soon as possible.

After the tear-off is completed, any old mastic and deteriorated flashing around chimneys and pipes should be removed, and the deck should be swept clean. The deck should then be inspected for split or warped sheathing boards, delaminated plywood panels, loose or high nails, dry rot in the sheathing or framing, and any other faults that could affect the quality of the shingling job. The roofing contractor should ensure that all needed repairs are made before proceeding with the job. This may involve some work by other trades.

The new asphalt shingles or wood shingles must have a sound and reasonably smooth nailing base. If the old roof is tile or slate, it must come off, since these materials are not nailable. Also, reshingling over an old wood-shake roof is not practicable, because the surface of the roof is too irregular. An existing asphalt-shingle or wood-shingle roof can usually remain in place if it is not badly weathered and if no doubt exists about the soundness of the sheathing. Any of the old shingles that are missing or rotted should be replaced, and any that are loose should be renailed. Wood shingles that are badly warped should be split and nailed down.

On very old houses with wood-shingle roofs, the shingle lath or lumber sheathing may be narrow and widely spaced. Because of this many of the nails used to install the new shingles may not penetrate a sheathing board, making for a very weak job. Old sheathing of this type should be replaced, filled in with additional boards, or covered with plywood sheathing.

### Loading of Materials on the Roof

An important reason for inspecting the roof structure before beginning a shingling job is to make sure it is strong enough to support the combined weight of the roofers and the stacked roofing materials. Sheathing that is weakened by cracks, large knotholes, or dry rot may give way suddenly under a concentrated load. Rake and eave overhangs are especially critical areas, on new roofs as well as old; they should never be loaded with roofing materials, and roofers should avoid walking or standing on them. Valleys are somewhat stronger than overhangs, and they are safe to walk on, but they, too, are poor places to load materials. The safest and most convenient place to stack unopened bundles of shingles is along the ridge. The hips of a roof are also suitable loading locations. Any materials that must be loaded elsewhere on the roof should be placed over rafters, not on unsupported parts of the sheathing. On steep roofs where the bundles would tend to slide, they should be placed on planks supported by roof jacks.

On one-story houses the roofing materials are often loaded directly from the truck onto the roof. On higher structures they are usually brought up to the roof by means of an A-frame hoist or a ladder loader. Whatever method is used, the shingle bundles and felt rolls must be placed carefully; they must never be dropped on the roof. Planning is important in the loading operation; the roofer should estimate the number of squares that are to be covered on each section of the roof and distribute the bundles accordingly. This will keep double handling of the bundles to a minimum.

## ASPHALT AND WOOD SHINGLING

## TOPIC 4—APPLICATION OF ASPHALT SHINGLES IN NEW CONSTRUCTION

This topic and the related instruction classes are designed to enable the apprentice to do the following:

- **Describe the steps in planning an asphalt shingling job in new construction.**
- **Discuss the requirements for a quality asphalt shingling job.**
- **Determine the total area of a roof that is to be shingled.**
- **Describe a typical procedure for applying three-tab strip shingles on a new deck.**
- **Distinguish between standard-size and metric strip shingles.**
- **Discuss the special requirements for low-slope application of three-tab strip shingles.**
- **Identify other types of asphalt shingles.**

### Job Planning

A well-planned and skillfully installed shingle roof can be regarded as a work of art. It enhances the beauty and value of the customer's home, and it improves the appearance of the entire neighborhood. A poor shingling job has the reverse effect. Since every shingle on a conventional pitched roof is visible from some angle, any that are misaligned, buckled, or off color will spoil the appearance of the roof and be a permanent and unwelcome reminder of the roofer who did the job.

#### Requirements for a Quality Shingling Job

The following are some points that should be kept in mind when planning a new shingling job:

1. Make sure the deck is soundly constructed, clean, and dry before beginning the shingling job. (Review Topic 3 in this workbook.) Roofing materials that are applied over a wet lumber deck may buckle or split as the sheathing boards dry out and shrink or warp. Plywood decking is not as susceptible to this problem.
2. Check the blueprints and specifications for the new structure to make sure that the plan for shingling the roof meets all the architect's roofing requirements. Also ensure that the job conforms with local building code requirements regarding fire and wind resistance, type and amount of felt underlayment, flashing, nailing, and the like.
3. If the architect's specifications do not spell out in complete detail the weight, pattern, color, and other characteristics of the required asphalt shingles, inform the owner or builder about the wide range of available asphalt shingle products, and provide assistance in choosing a type that best suits the conditions of the job. Listed below are some characteristics of asphalt shingles that should be considered in making the selection:
   - Light-colored shingles reflect heat better and therefore last longer than dark shingles of the same quality.
   - Heavy shingles withstand wind best. Seal-tab shingles and interlocking shingles have high resistance to wind, but they are not completely windproof. For example, wind pressure under a deck that is not airtight can split or loosen the roofing material or even blow it off. Also, seal-tab shingles may lift in a strong wind if the new roof has not been exposed to the sun long enough to ensure good bonding of the tabs. The best adhesion occurs if the shingles are installed in warm weather (above 70° F. [21.1° C]).
   - Low-sloped shingle roofs (less than 4/12 but never less than 2/12) require two layers of No. 15 felt underlayment, and the shingles must be a self-sealing type or be hand-sealed with a spot of adhesive under each tab.
   - Three-tab shingles are sometimes specified instead of standard shingles on premium-quality jobs where their higher cost is not a consideration.
   - Shingles installed over an insulated deck will deteriorate faster than would otherwise be the case, because they cannot transfer their heat to the deck below. The retained heat speeds up evaporation of the oils in the asphalt, which shortens the life of the roof. The shingle manufacturer should be consulted for advice in selecting the best type of asphalt shingle for jobs of this type.
4. Take care when applying the shingles to ensure that the horizontal, vertical, and diagonal lines formed by the installed shingles will be straight and evenly spaced.

### Estimates of the Needed Materials

An important step in planning a shingling job is estimating the quantities of shingles, felt underlayment, nails, metal edging, flashing, pipe jacks, and other materials that will be needed to complete the job. If too little of some material has been ordered, the roofer will have to interrupt the job and return to the shop to make up the shortage. The resulting delay will reduce the efficiency of the roofing operation and increase its cost. Overordering should also be avoided. Most roofers increase their material estimates by a small amount to allow for waste, but if too much material is delivered to the jobsite, the unused material will have to be returned, and the extra handling will also add to the cost of the job.

Estimates of the number of bundles of shingles and rolls of felt required for a job are based on area calculations made from the dimensions of the roof. The calculations are relatively simple, even if the roof has a complex shape, and they can be made by checking the dimensions given in the plans. Most residential roofs consist of plane surfaces that can be broken down into simple geometric shapes, such as squares, rectangles, and triangles, and the sum of the areas of these smaller shapes is the total area of the roof. Two common types of simple roofs are illustrated in Figure 4-1. The shed roof consists of only one rectangle; its total area can be found by simply multiplying the rake line by the eave line (A × B). The gable roof consists of two adjoining rectangles, and the total area of the roof is equal to the sum of the rake lines (B + C) multiplied by the eave line (A).

Convenient methods for making the required area calculations for more complex roofs with wings, dormers, and ridges at different elevations are described in the *Residential Asphalt Roofing Manual*, published by the Asphalt Roofing Manufacturers Association (ARMA), and other technical publications of the roofing industry. (See the Instructional Materials section on page 50 of this workbook. Information will also be found in the forthcoming book in this series on plans and specifications.)

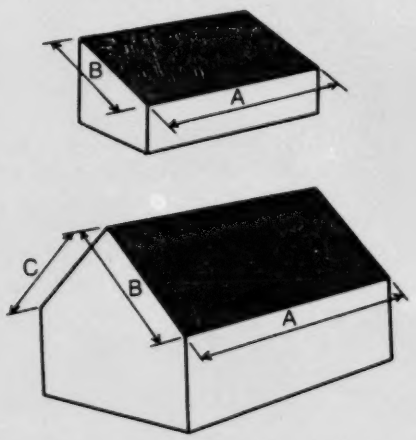



**Fig. 4-1. Area measurements for a shed roof (*top*) and a gable roof (*bottom*)**

Knowing the total roof area, the roofer can determine the number of bundles of shingles that will be needed for a job by referring to the coverage data provided by the shingle manufacturer. The required quantities of hip and ridge shingles, metal drip edging, and flashing materials are found by measuring or estimating the lengths of the hips, ridges, valleys, eaves and rakes, and intersections of the roof at adjoining walls, dormers, chimneys, and the like.

### Application of Three-Tab Strip Shingles

Asphalt shingles are manufactured in three basic patterns: strip shingles, interlocking shingles, and large individual shingles. The pattern most often encountered is the strip shingle, which may have two or more tabs (one or more cutouts) or a single tab that extends the full length of the shingle (no cutouts). The most popular version of the strip shingle is the three-tab square-butt strip shingle. (See Table 1-1 in Topic 1.)

The general application procedure that follows is for three-tab shingles; however, all types of strip shingles are installed in basically the same way. Detailed application instructions are normally provided by the shingle manufacturer, and the manufacturer's instructions should be followed on the job. Additional useful information about asphalt-shingle roofing materials and methods can be found in the publications listed in the Instructional Materials section.

### Applying Felt Underlayment, Metal Drip Edges, and Eaves Flashing

After the new deck has been inspected and found to be in good condition, it must be covered with felt underlayment, and it should be finished at the rakes and eaves with metal drip edges. Also, in climates where icing could occur along the eaves and force water under the roofing, local codes may require installation of eaves flashing consisting of additional felt or smooth roll roofing extending up the roof from the eaves to a point 12 inches (30.5 centimetres) or more beyond the inside of the wall. (See Fig. 4-2.)

Underlayment consisting of a single layer of No. 15 felt is usually specified for roofs having a slope of 4/12 or more. However, local codes may require the use of heavier felt or an additional layer of No. 15 felt, particularly if the roof has a low slope (less than 4/12). Ordinary asphalt-saturated nonperforated felt should be used as underlayment; coated felt or tar-saturated

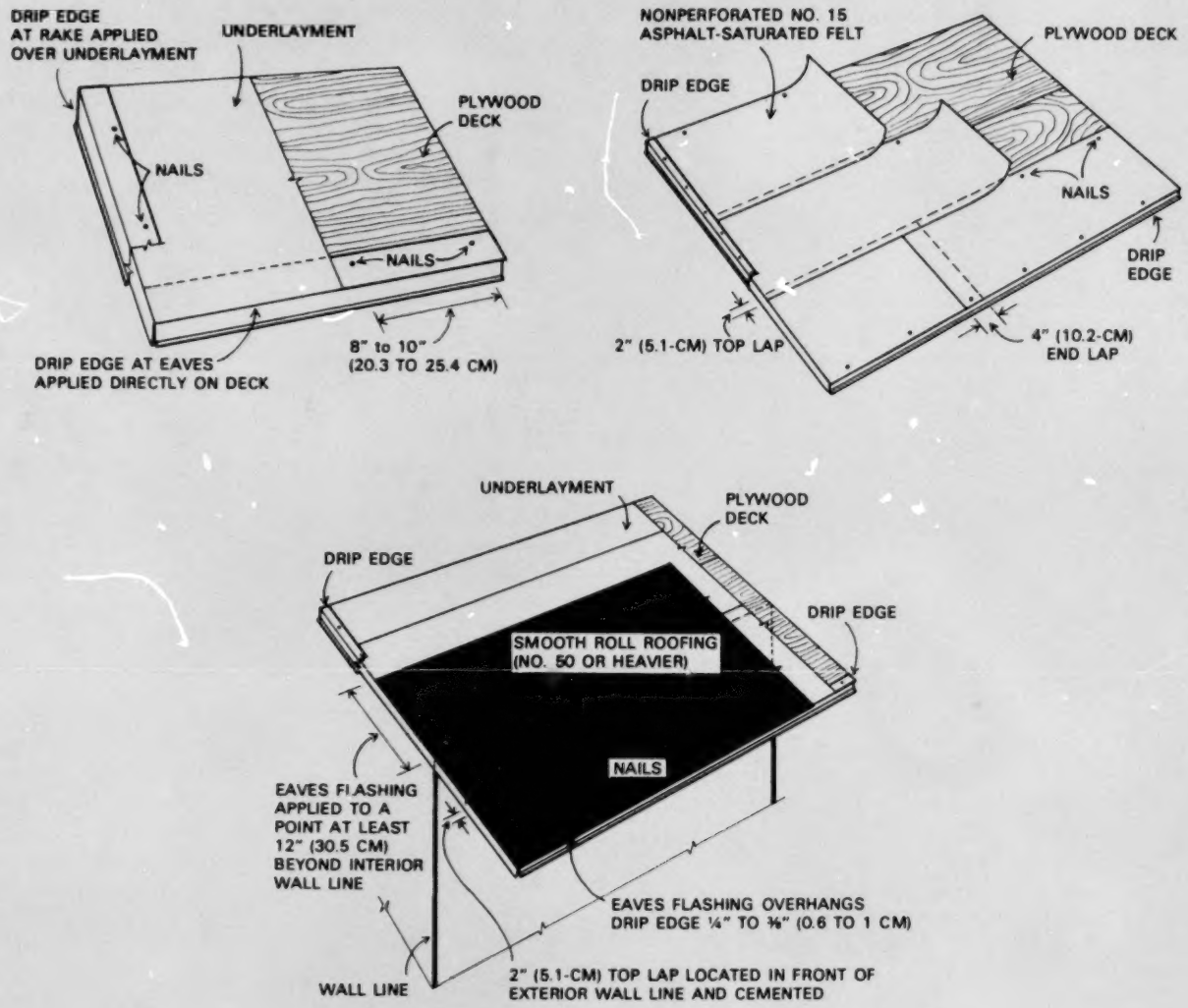

DRIP EDGE AT RAKE APPLIED OVER UNDERLAYMENT
UNDERLAYMENT
PLYWOOD DECK
NAILS
NAILS
DRIP EDGE AT EAVES APPLIED DIRECTLY ON DECK
8" to 10" (20.3 TO 25.4 CM)
NONPERFORATED NO. 15 ASPHALT-SATURATED FELT
PLYWOOD DECK
DRIP EDGE
NAILS
DRIP EDGE
2" (5.1-CM) TOP LAP
4" (10.2-CM) END LAP
UNDERLAYMENT
PLYWOOD DECK
DRIP EDGE
DRIP EDGE
SMOOTH ROLL ROOFING (NO. 50 OR HEAVIER)
NAILS
EAVES FLASHING APPLIED TO A POINT AT LEAST 12" (30.5 CM) BEYOND INTERIOR WALL LINE
EAVES FLASHING OVERHANGS DRIP EDGE ¼" TO ⅜" (0.6 TO 1 CM)
WALL LINE
2" (5.1-CM) TOP LAP LOCATED IN FRONT OF EXTERIOR WALL LINE AND CEMENTED

**Fig. 4-2. Application of drip edges, felt underlayment, and eaves flashing**

felt can act as a vapor barrier and trap moisture between the shingle roof and the deck. The deck must be clean and dry before the felt is placed.

The main purpose of the galvanized-metal drip edges is to shed water at the edges of the deck and thereby prevent rotting of the rake and eave overhangs. The eaves metal is nailed to the deck after the felt is laid, and the metal at the rakes is placed over the felt, as shown in Figure 4-2.

### Using Chalk Lines in Layout Work

Asphalt shingles are manufactured with close quality control, but their dimensions may vary slightly from bundle to bundle and even from shingle to shingle within a bundle. These slight variations do not affect the quality of the shingles; however, their cumulative effect can result in diverging butt lines and misaligned cutouts if the shingles are laid without frequent checking to ensure their correct placement. Most shingle manufacturers recommend the use of horizontal and vertical chalk lines for this purpose. The chalk lines are helpful guides, but they do not eliminate the need for the shingle gage, which is the roofer's basic layout tool. Some roofers prefer to start shingling without the chalk lines, relying instead on the shingle gage and a tape rule to maintain alignment of the shingles.

To establish a chalk line, the roofer should measure up from the eaves or in from the rake the desired amount at three locations—the two ends and the midpoint of the line—and drive a nail at each of these points. The chalk line should be stretched tight between the two end nails so that it touches the center nail and rests on the felt underlayment. The roofer then lifts the chalk line 2 or 3 inches (5.1 or 7.6 centimetres) and lets it snap back down onto the felt to transfer the line.

On a long roof it may be desirable to establish a vertical chalk line that intersects the horizontal lines at their midpoints, then apply the shingles to the left and right of the vertical line; this will help preserve the alignment of the cutouts. Also, the spacing of the horizontal chalk lines may have to be adjusted slightly as they approach the ridge so that the top course of shingles will be parallel with the ridge.

**Flashing a Valley**

Valleys are formed where two sloping roof planes meet at an inside angle. Since water runoff is concentrated in the valleys, they are especially vulnerable to leakage, and they must be properly flashed. The first step in flashing a valley is accomplished before the felt underlayment is placed. (See Fig. 4-3.) A strip of No. 15 felt 36 inches (91.4 centimetres) wide is centered in the valley and fastened with a few nails along each edge of the strip. The nails should be located not more than 1 inch (2.5 centimetres) in from the edges of the valley flashing, and the nail heads should be covered by the next course of roofing material. Next, the horizontal courses of felt underlayment are installed and trimmed at an angle so they overlap the valley flashing strip at least 6 inches (15.2 centimetres), as shown in Figure 4-3.

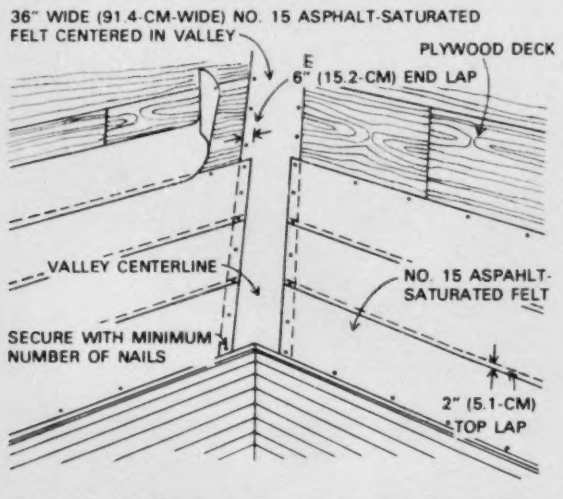

36" WIDE (91.4-CM-WIDE) NO. 15 ASPHALT-SATURATED FELT CENTERED IN VALLEY
PLYWOOD DECK
6" (15.2-CM) END LAP
VALLEY CENTERLINE
NO. 15 ASPAHLT-SATURATED FELT
SECURE WITH MINIMUM NUMBER OF NAILS
2" (5.1-CM) TOP LAP

**Fig. 4-3. Application of underlayment in a valley**

The next step in flashing a valley depends on the type of valley (open, woven, or closed cut) and whether the flashing material is to be roll roofing or galvanized metal. In an open valley the shingles of the two adjoining roof sections do not meet at the centerline of the valley; instead, they are trimmed short of the line at an angle, overlapping the edges of the valley flashing but leaving the center portion of the flashing exposed. In woven and closed-cut valleys, the shingles are interlaced or overlapped at the valley centerline. (See Figs. 4-4, 4-5, and 4-6.)

Open valleys are often flashed with No. 90 mineral-surfaced roll roofing, as shown in Figure 4-4. The flashing is applied in two layers. The first layer, which is 18 inches (45.7 centimetres) wide, is centered in the valley, with the mineral surface facing down. Again, only a few nails should be used to secure the flashing strip, and they should be not more than 1 inch (2.5 centimetres) in from each edge of the strip. If the flashing strip must be made up of two or more lengths, the pieces must be lapped at least 12 inches (30.5 centimetres), and the lap joint must be well bonded with plastic cement. Next, a 36-inch-wide (91.4-centimetre-wide) strip of the roll roofing is placed over the first strip, this time with the mineral surface facing up. The edge nailing and lap treatment of this strip are the same as for the 18-inch (45.7-centimetre) strip. Chalk lines are then snapped onto the flashing to mark the valley centerline and the trim

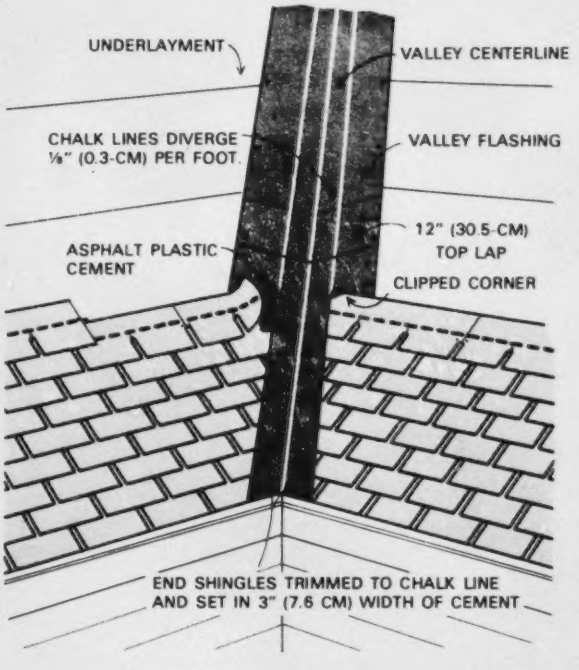

UNDERLAYMENT
VALLEY CENTERLINE
CHALK LINES DIVERGE ⅛" (0.3-CM) PER FOOT
VALLEY FLASHING
12" (30.5-CM) TOP LAP
ASPHALT PLASTIC CEMENT
CLIPPED CORNER
END SHINGLES TRIMMED TO CHALK LINE AND SET IN 3" (7.6 CM) WIDTH OF CEMENT

**Fig. 4-4. A typical open-valley application**

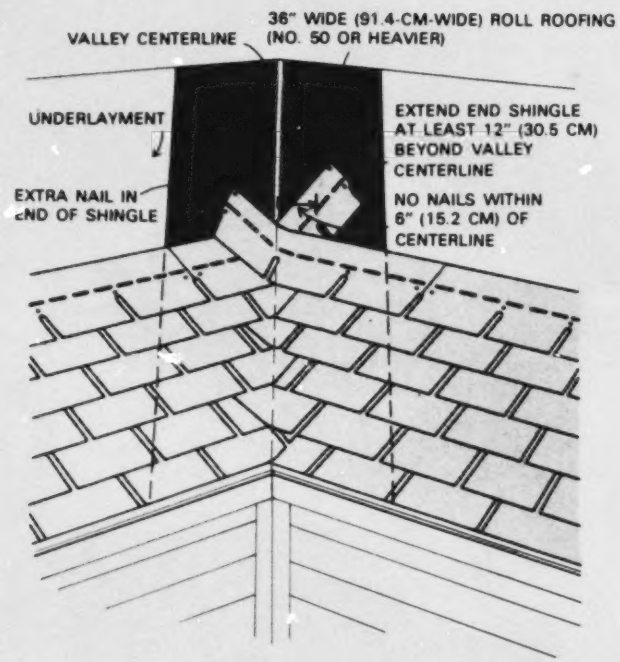

VALLEY CENTERLINE
36" WIDE (91.4-CM-WIDE) ROLL ROOFING (NO. 50 OR HEAVIER)
UNDERLAYMENT
EXTRA NAIL IN END OF SHINGLE
EXTEND END SHINGLE AT LEAST 12" (30.5 CM) BEYOND VALLEY CENTERLINE
NO NAILS WITHIN 6" (15.2 CM) OF CENTERLINE

Fig. 4-5. A typical woven-valley application

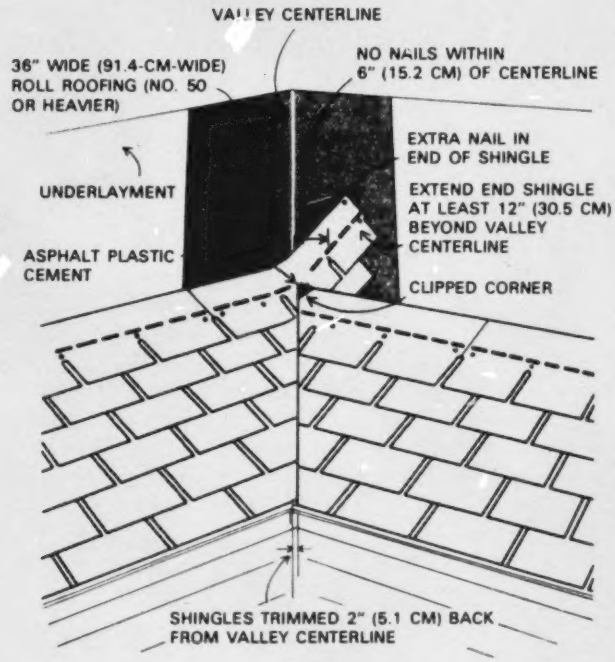

VALLEY CENTERLINE
36" WIDE (91.4-CM-WIDE) ROLL ROOFING (NO. 50 OR HEAVIER)
NO NAILS WITHIN 6" (15.2 CM) OF CENTERLINE
EXTRA NAIL IN END OF SHINGLE
UNDERLAYMENT
EXTEND END SHINGLE AT LEAST 12" (30.5 CM) BEYOND VALLEY CENTERLINE
ASPHALT PLASTIC CEMENT
CLIPPED CORNER
SHINGLES TRIMMED 2" (5.1 CM) BACK FROM VALLEY CENTERLINE

Fig. 4-6. A typical closed-cut valley application

lines for the shingles. Alternatively, metal valley flashing may be used in place of the mineral-surfaced roll roofing; if this is done, the metal flashing is usually applied over a 36-inch-wide (91.4-centimetre-wide) strip of No. 30 or heavier roll roofing. The metal flashing is edge-nailed and lapped in the same ways as roll-roofing flashing.

The flashing material for woven valleys and closed-cut valleys is usually a 36-inch-wide (91.4-centimetre-wide) strip of No. 50 or heavier roll roofing, which may be either smooth surfaced or mineral surfaced. (See Figs. 4-5 and 4-6.)

### Applying the Starter Course

The starter course gives added protection to the roof by filling in the cutouts and joint spaces in the first course of shingles and providing double coverage in the vulnerable eaves area. The starter strip may be either a row of shingles with the tabs cut off or a strip of mineral-surfaced roll roofing at least 7 inches (17.8 centimetres) wide. The starter strip should overhang the eaves and rakes by ¼ to ⅜ inch (0.6 to 1 centimetre). (See Fig. 4-7.) When nailing the starter strip, the roofer should take care to position the nails so that their heads will not be exposed under the cutouts in the first course of shingles.

### Applying the First Course and the Following Courses

Before starting to apply the shingles, the roofer should make sure that all the materials needed to complete the job are at hand, including flashings and sealants for weatherproofing around chimneys and vent pipes and at locations where the roof meets a wall or a dormer. If the roof surface is interrupted by a valley or a dormer, the shingling should start from a rake and proceed toward the valley or dormer; if there is no break in the roof surface, the shingling should start at the rake that is most visible. Regardless of where the shingle application begins, the preferred method is to "staircase" the shingles across and diagonally up the roof. This will ensure that no shingle is overlooked during nailing, since each one remains visible until it is covered by the course above.

Careful alignment of the first course of shingles is especially important in terms of the appearance of the roof. If the first course is not laid perfectly straight, the error will be repeated in the second and following courses as the roofer sets the exposure with the shingle gage. Use of a horizontal chalk line is helpful for maintaining alignment of the first course. Likewise, a few accurately spaced vertical chalk lines extending up from the ends of the shingles in the first course will

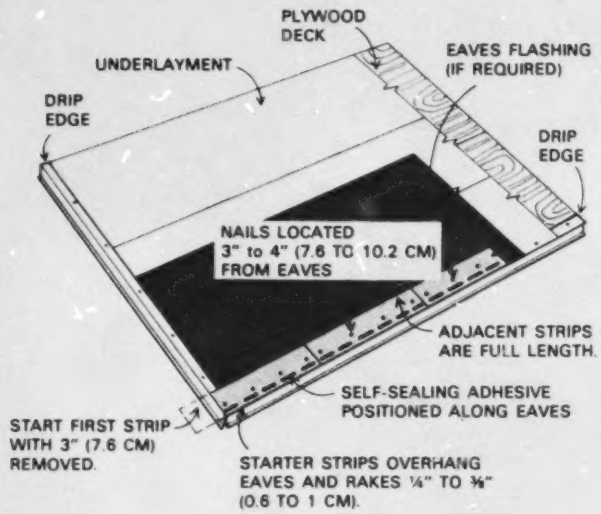

PLYWOOD DECK
UNDERLAYMENT
EAVES FLASHING (IF REQUIRED)
DRIP EDGE
DRIP EDGE
NAILS LOCATED 3" to 4" (7.6 TO 10.2 CM) FROM EAVES
ADJACENT STRIPS ARE FULL LENGTH.
SELF-SEALING ADHESIVE POSITIONED ALONG EAVES
START FIRST STRIP WITH 3" (7.6 CM) REMOVED.
STARTER STRIPS OVERHANG EAVES AND RAKES ¼" TO ⅜" (0.6 TO 1 CM).

**Fig. 4-7. Application of the starter course**

make it easier to align the cutouts in the following courses.

When the "staircase" method of application is used, the first course starts with a full-length shingle, and the following courses start with shingles that have been trimmed to progressively shorter lengths to produce the diagonal pattern. A right-handed roofer should trim the left sides of the shingles; conversely, a left-handed roofer would trim the right ends of the shingles. The amount trimmed off the starter shingles depends on the amount of offset desired for the cutouts; three-tab strip shingles of standard length (36 inches [91.4 centimetres]) are commonly applied with offsets of 4, 5, or 6 inches (10.2, 12.7, or 15.2 centimetres). (Metric shingles are about 10 percent longer than standard shingles, and the offsets are correspondingly longer.) The shingles that follow the starter shingle in each course are all full-length shingles.

*Application with a 6-inch (15.2-centimetre) offset.* A method of applying standard shingles with a 6-inch (15.2-centimetre) offset and 5-inch (12.7-centimetre) exposure to the weather is shown in Figure 4-8. The first course starts with a full-length shingle, and each of the following courses up to the sixth course starts with a shingle from which 6 inches (15.2 centimetres) or some multiple of 6 inches (15.2 centimetres) has been removed. Thus, the second course starts with a shingle that has been shortened 6 inches (15.2 centimetres) so that its length is now 30 inches (76.2 centimetres); the third course starts with a shingle that has been shortened 12 inches (30.5 centimetres) so that its length is now 24 inches (61 centimetres); and so on until the sixth course has been reached. The sixth course starts with a shingle only 6 inches (15.2 centimetres) long. The seventh course starts again with a full-length shingle, and the pattern is repeated until the ridge is reached.

*Application with a 5-inch (12.7-centimetre) offset.* If the shingles are to be laid with a 5-inch (12.7 centimetre) offset, the first course starts with a full shingle, and the second through the seventh courses start with a shingle from which 5 inches (12.7 centimetres) or some multiple of 5 inches (12.7 centimetres) has been removed. (See Fig. 4-9.) The second course starts

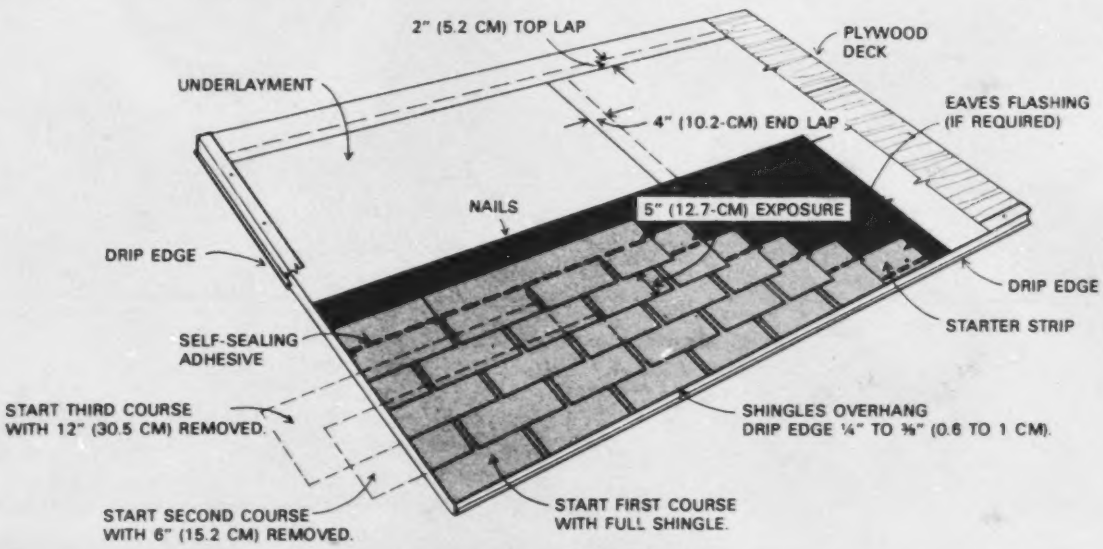

2" (5.2 CM) TOP LAP
PLYWOOD DECK
UNDERLAYMENT
EAVES FLASHING (IF REQUIRED)
4" (10.2-CM) END LAP
NAILS
5" (12.7-CM) EXPOSURE
DRIP EDGE
DRIP EDGE
STARTER STRIP
SELF-SEALING ADHESIVE
START THIRD COURSE WITH 12" (30.5 CM) REMOVED.
SHINGLES OVERHANG DRIP EDGE ¼" TO ⅜" (0.6 TO 1 CM).
START SECOND COURSE WITH 6" (15.2 CM) REMOVED.
START FIRST COURSE WITH FULL SHINGLE.

**Fig. 4-8. Shingle application using the 6-inch (15.2-centimetre) method**

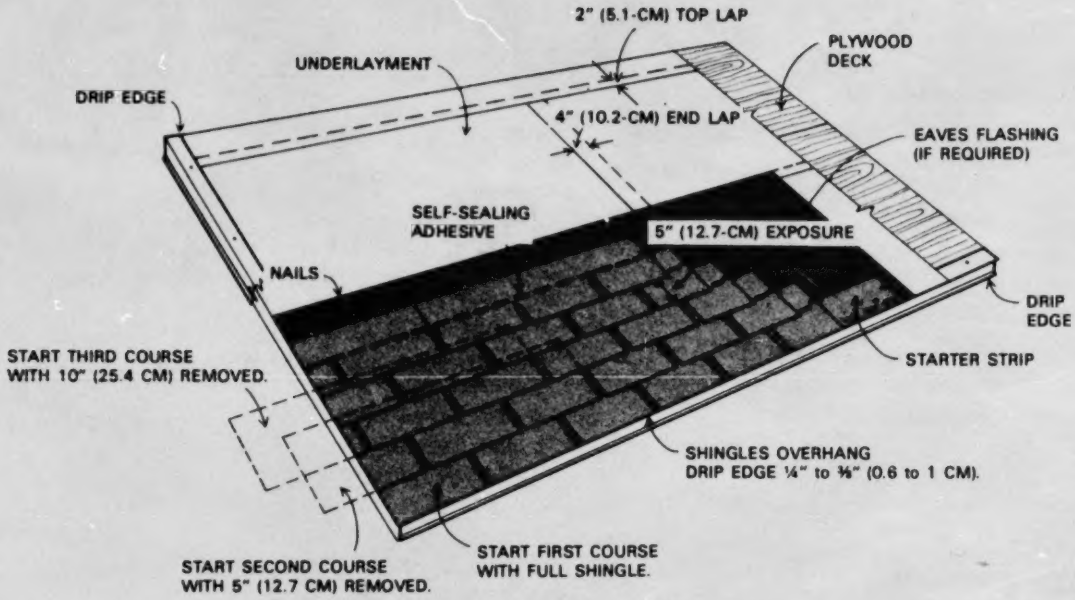

2" (5.1-CM) TOP LAP
PLYWOOD DECK
UNDERLAYMENT
DRIP EDGE
4" (10.2-CM) END LAP
EAVES FLASHING (IF REQUIRED)
SELF-SEALING ADHESIVE
5" (12.7-CM) EXPOSURE
NAILS
DRIP EDGE
START THIRD COURSE WITH 10" (25.4 CM) REMOVED.
STARTER STRIP
SHINGLES OVERHANG DRIP EDGE ¼" to ⅜" (0.6 to 1 CM).
START FIRST COURSE WITH FULL SHINGLE.
START SECOND COURSE WITH 5" (12.7 CM) REMOVED.

**Fig. 4-9. Shingle application using the 5-inch (12.7-centimetre) method**

with a shingle that has been trimmed off 5 inches (12.7 centimetres), the third course starts with one that has been trimmed off 10 inches (25.4 centimetres), and so on up to the seventh course, which starts with a shingle that has been trimmed off 30 inches (76.2 centimetres). The seventh course starts with a 6-inch (15.2-centimetre) shingle, therefore, instead of a 5-inch (12.7-centimetre) shingle, which eliminates one trimming cut and avoids having an unusable 1-inch (2.5-centimetre) strip of shingle left over. This minor variation in the 5-inch (12.7-centimetre) pattern is not noticeable and does not affect the quality of the job.

The pattern is repeated beginning with the eighth course, which again starts with a full-length shingle.

*Alternate layout method for a 5-inch (12.7-centimetre) offset.* Another method of cutting the starter shingles to produce a staircase pattern with a 5-inch (12.7-centimetre) offset is shown in Figure 4-10. Using this method, the roofer can obtain all the shortened starter shingles needed to complete the staircase pattern by making only four cuts in three full shingles, as shown at the left in the illustration. The order in which the starter shingles are installed is shown at the right. As in the other application methods described in this topic, the first course starts with a full shingle, and full shingles are used after the starter shingle in each course. (Note that the offset between the fourth and fifth courses is 6 inches [15.2 centimetres] instead of 5 inches [12.7 centimetres]. As in the previously described 5-inch [12.7-centimetre] method, this minor variation in the length of the offsets is not objectionable.)

*Application with a 4-inch (10.2-centimetre) offset.* Three-tab strip shingles may be installed with a 4-inch (10.2-centimetre) offset by the method illustrated in Figure 4-11. The first course starts with a full shingle, and the second through the ninth courses start with shingles that have been trimmed off 4 inches (10.2 centimetres) or some multiple of 4 inches (10.2 centimetres). Thus, the second course starts with a 32-inch (81.3-centimetre) shingle, the third course with a 28-inch (71.1-centimetre) shingle, and so on until the ninth course, which starts with a 4-inch (10.2-centimetre) shingle. The pattern is repeated beginning with the tenth course.

Asphalt strip shingles should never be installed with less than a 4-inch (10.2-centimetre) offset.

### Applying Metric Shingles

The application procedures described thus far in this topic are for standard-size asphalt strip shingles, which are approximately 12 inches (30.5 centimetres) wide and 36 inches (91.4 centimetes) long. With minor changes these procedures can also be used to apply metric-dimensioned strip shingles, which differ from standard shingles only in size (33.6 centimetres x 100 centimetres [13¼ inches x 39⅜ inches]). Because of their greater length and width, metric shingles are applied with more cutout offset and increased exposure. The cutouts on a metric shingle are spaced 33.3

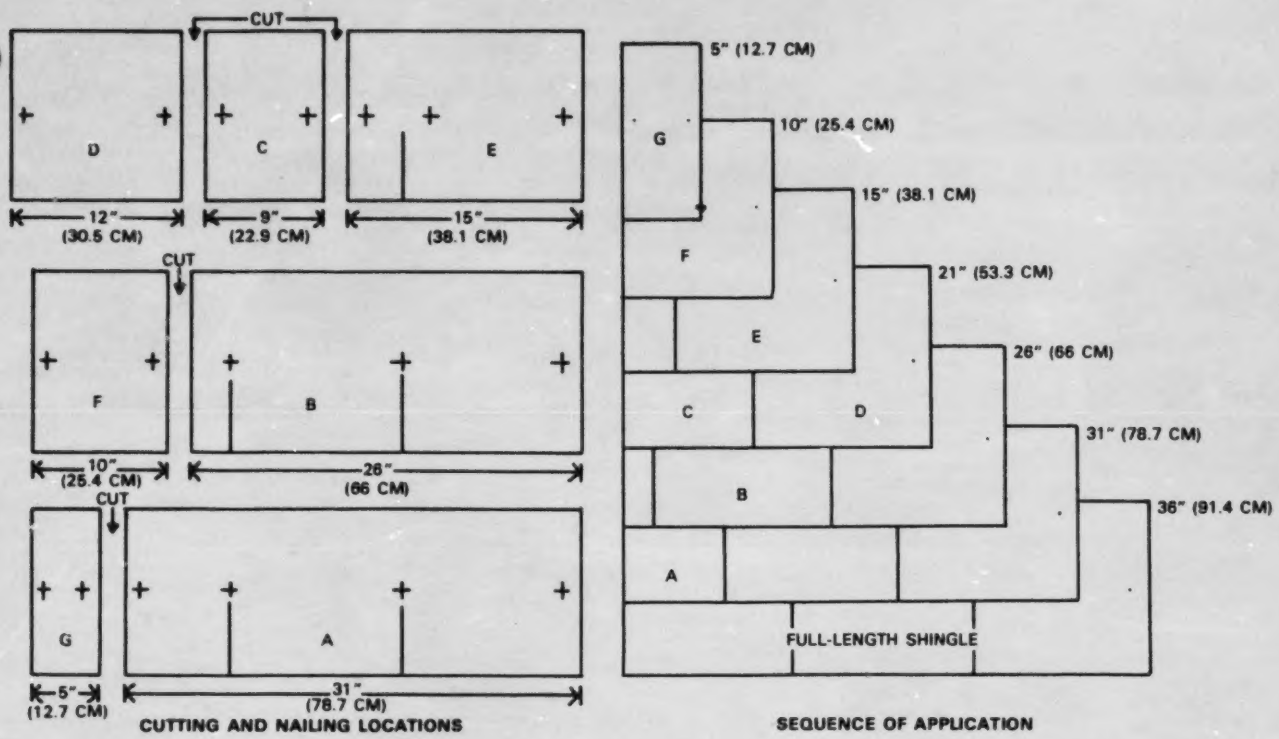



**Fig. 4-10. Alternate layout for starter shingles with a 5-inch (12.7-centimetre) offset**

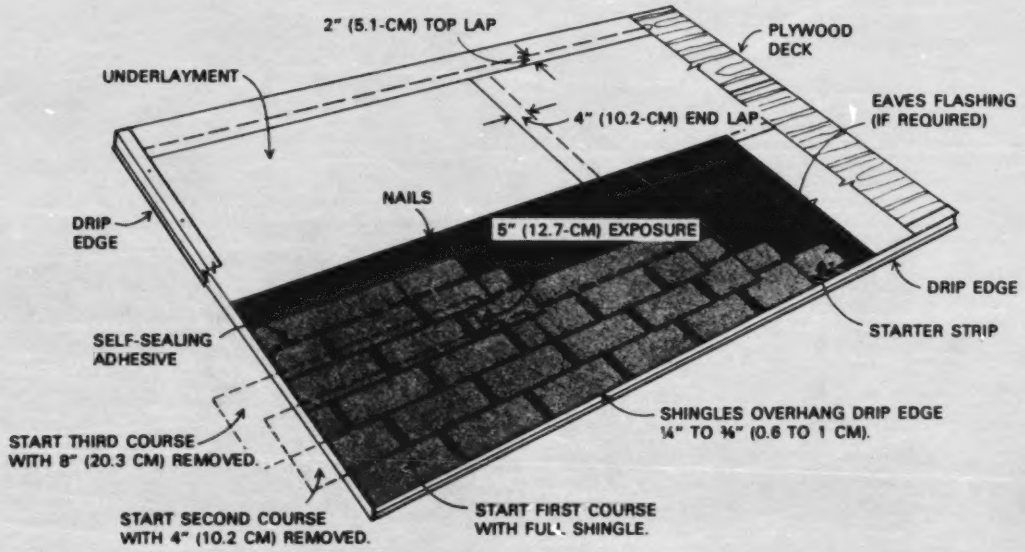

2" (5.1-CM) TOP LAP
PLYWOOD DECK
UNDERLAYMENT
EAVES FLASHING (IF REQUIRED)
4" (10.2-CM) END LAP
NAILS
DRIP EDGE
5" (12.7-CM) EXPOSURE
DRIP EDGE
STARTER STRIP
SELF-SEALING ADHESIVE
SHINGLES OVERHANG DRIP EDGE ¼" TO ⅜" (0.6 TO 1 CM).
START THIRD COURSE WITH 8" (20.3 CM) REMOVED.
START SECOND COURSE WITH 4" (10.2 CM) REMOVED.
START FIRST COURSE WITH FULL SHINGLE.

**Fig. 4-11. Shingle application using the 4-inch (10.2-centimetre) method**

centimetres (13⅛ inches) on centers, compared with 12 inches (30.5 centimetres) on centers for the cutouts on a standard shingle; therefore, to install metric shingles with the cutouts offset to the midpoint of the tabs, as shown for standard shingles in Figure 4-8, the offset is increased from 6 inches (15.2 centimetres) to 6 9/16 inches (16.6 centimetres). The standard exposure for metric shingles is 5⅝ inches (14.3 centimetres). Nailing patterns are the same as for standard-size shingles.

An advantage of using metric shingles is that the job can be completed in less time and at lower cost than with standard-size shingles. With conventional roofing 80 shingles and 320 nails are needed to cover a square; if metric shingles are used, only 66 shingles and 264 nails are needed to cover the same area.

**Fastening the Shingles**

Proper fastening is essential for good performance of a shingle roof. To ensure proper fastening, the shingler should follow these rules:

- Use the correct size and grade of fastener, as specified by the shingle manufacturer.
- Use zinc-coated fasteners for protection against corrosion.
- Use the recommended number of fasteners per shingle. A three-tab strip shingle normally requires four nails or staples, located as shown in Figure 4-12. Where high winds may be encountered, six

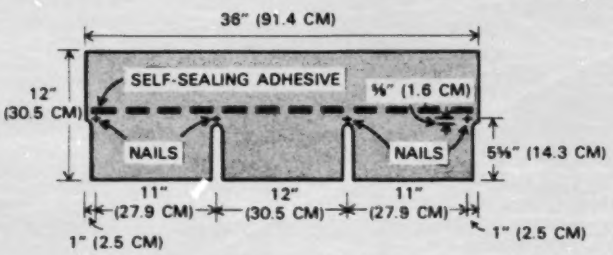



**Fig. 4-12. Nail locations for a three-tab strip shingle**

fasteners may be required to secure a three-tab strip shingle.

- Align the shingles properly to avoid exposing the fasteners in the course below.
- Drive the fasteners straight, and do not break the shingle surface with the fastener head.
- If a fastener does not have sound bearing, do not rely on it to hold the shingle securely in place. Remove it carefully, seal the hole with plastic cement, and drive another fastener nearby.
- When nailing at overhangs and in porch areas, make sure the nails do not penetrate through the exposed underside of the sheathing.

**Flashing at Vertical Walls, Chimneys, and Vent Pipes**

Flashing is required not only at valleys but also wherever the roof meets a vertical wall or is penetrated by a chimney or a vent pipe. Since defective flashing is the source of most roofing failures, this part of the shingling job must be given careful attention.

*Flashing against a vertical side wall.* A section of roof that adjoins a vertical wall is best flashed by means of metal step flashing ("flashing shingles") placed at the end of each course, as shown in Figure 4-13. The rectangular metal flashing shingles are cut 10 inches (25.4 centimetres) long and 2 inches (5.1

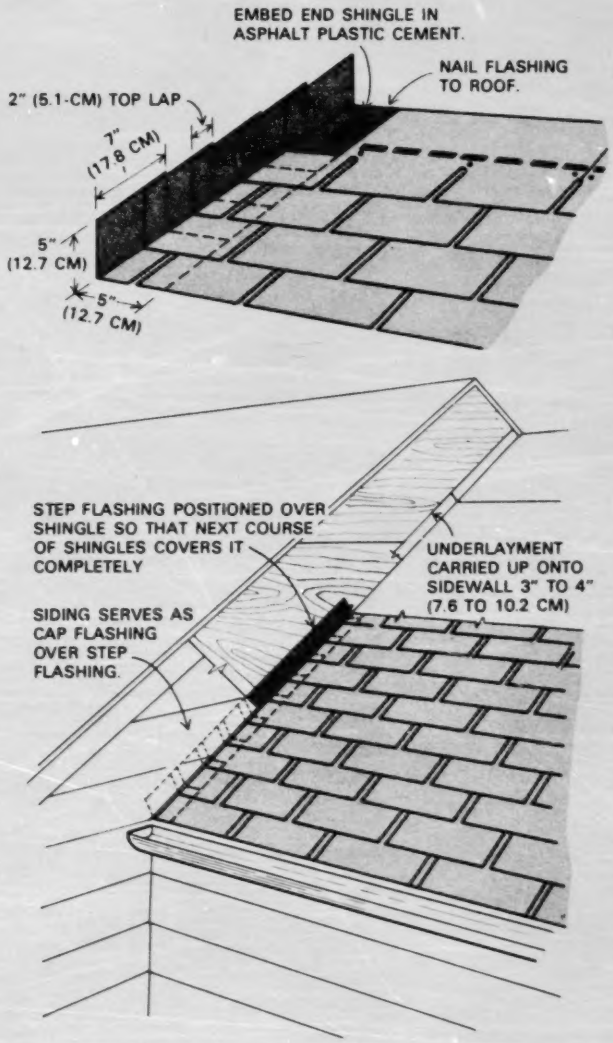

EMBED END SHINGLE IN ASPHALT PLASTIC CEMENT.
NAIL FLASHING TO ROOF.
2" (5.1-CM) TOP LAP
7" (17.8 CM)
5" (12.7 CM)
5" (12.7 CM)
STEP FLASHING POSITIONED OVER SHINGLE SO THAT NEXT COURSE OF SHINGLES COVERS IT COMPLETELY
UNDERLAYMENT CARRIED UP ONTO SIDEWALL 3" TO 4" (7.6 TO 10.2 CM)
SIDING SERVES AS CAP FLASHING OVER STEP FLASHING.

**Fig. 4-13. Application of step flashing at a vertical side wall**

centimetres) wider than the exposed face of the asphalt shingles. For example, when the metal flashing shingles are used with strip shingles having a 5-inch (12.7-centimetre) exposure, they measure 10 x 7 inches (25.4 x 17.8 centimetres). The 10-inch (25.4-centimetre) length is bent to extend 5 inches (12.7 centimetres) under the asphalt shingles and 5 inches (12.7 centimetres) up the wall, and the 7-inch (17.8-centimetre) length permits the metal flashing shingles to overlap each other by 2 inches (5.1 centimetres). The flashing is nailed to the deck but not to the wall, since settling of the roof could produce stresses in the flashing and result in a leak. Water is kept from entering the space between the vertical wall and the step flashing by the siding that is applied later on the vertical wall. The siding extends over the step flashing and serves as counterflashing.

*Flashing at chimneys and vent pipes.* Flashing around a chimney must be installed in a manner that provides a reliable water seal and at the same time permits a small amount of movement to occur between the chimney and the roof. The first step in flashing a chimney is to install a water diverter (also called a cricket) at the back face of the chimney on the high side of the roof slope, as shown in Figure 4-14.

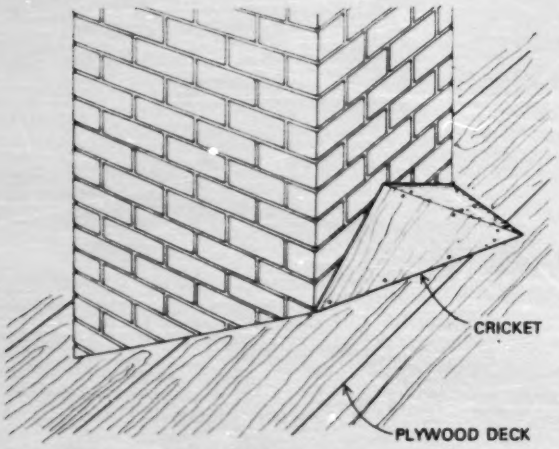



**Fig. 4-14. A chimney cricket**

The cricket should be in place before the felt underlayment is laid, since all the roofing materials from the felt to the shingles are carried over it.

The asphalt shingles should be applied up to the front face of the chimney before any flashings are installed. On reroofing work, a coat of asphalt primer should be brushed on the brickwork to seal the surface and improve adhesion at all points where plastic cement will later be applied. Galvanized-metal base flashing is then cut to size and bent to fit the chimney and provide an apron over the shingles at the front face, as shown in Figure 4-15.

Next, metal step flashing is installed on both sides of the chimney in basically the same manner as flashing at a vertical side wall. Each metal flashing unit is nailed to the deck and interwoven with the asphalt shingles, as shown in Figure 4-16.

The rear base flashing is now installed over the cricket and against the back of the chimney, as illustrated in figures 4-17, 4-18, and 4-19. The metal base flashing is cut and bent to cover the cricket and extend

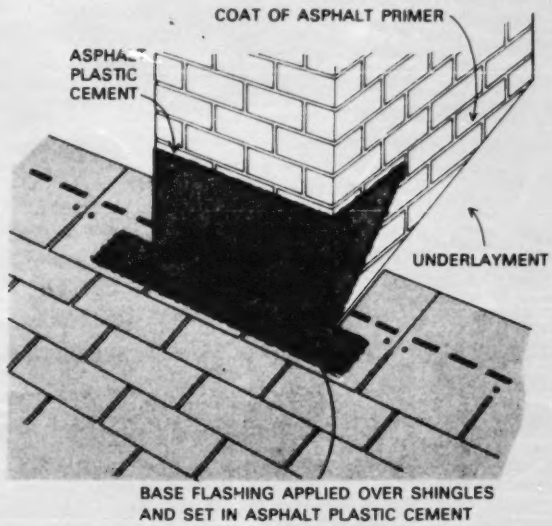

COAT OF ASPHALT PRIMER
ASPHALT PLASTIC CEMENT
UNDERLAYMENT
BASE FLASHING APPLIED OVER SHINGLES AND SET IN ASPHALT PLASTIC CEMENT

**Fig. 4-15. Application of base flashing at the front of a chimney**

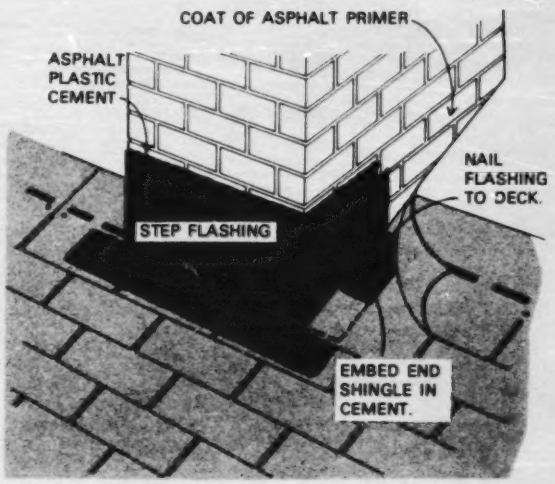



**Fig. 4-16. Application of base flashing at the sides of a chimney**

onto the roof surface at least 6 inches (15.2 centimetres). It should also extend at least 6 inches (15.2 centimetres) up the brickwork and far enough laterally to lap the step flashing on the sides of the chimney.

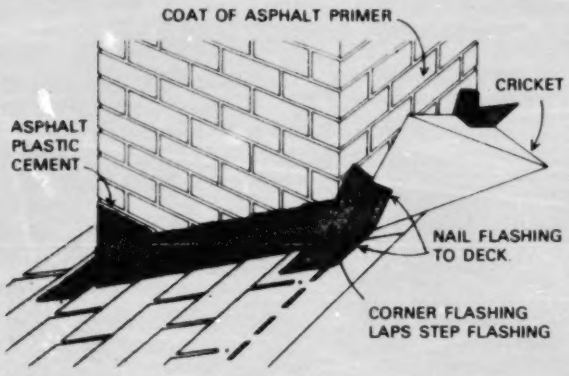



**Fig. 4-17. Application of corner base flashing at the rear of a chimney**

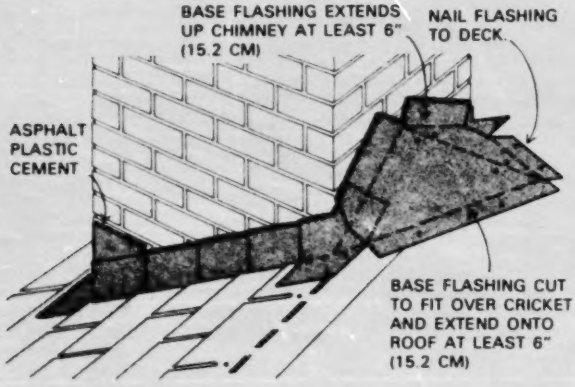

BASE FLASHING EXTENDS UP CHIMNEY AT LEAST 6" (15.2 CM)
NAIL FLASHING TO DECK
ASPHALT PLASTIC CEMENT
BASE FLASHING CUT TO FIT OVER CRICKET AND EXTEND ONTO ROOF AT LEAST 6" (15.2 CM)

**Fig. 4-18. Application of base flashing over a cricket**

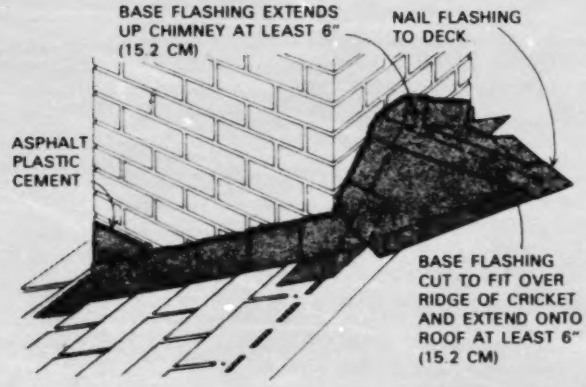

BASE FLASHING EXTENDS UP CHIMNEY AT LEAST 6" (15.2 CM)
NAIL FLASHING TO DECK
ASPHALT PLASTIC CEMENT
BASE FLASHING CUT TO FIT OVER RIDGE OF CRICKET AND EXTEND ONTO ROOF AT LEAST 6" (15.2 CM)

**Fig. 4-19. Application of base flashing over a cricket ridge**

Cap flashings (also called cou erflashings) must then be installed over all the b flashings to shed water that would otherwise enter between the brickwork and the base flashing. The cap flashing is set into the brickwork by raking out a mortar joint to a depth of about 1½ inches (3.8 centimetres), as shown in Figure 4-20, then refilling the joint with fresh mortar and pressing in the metal flashing.

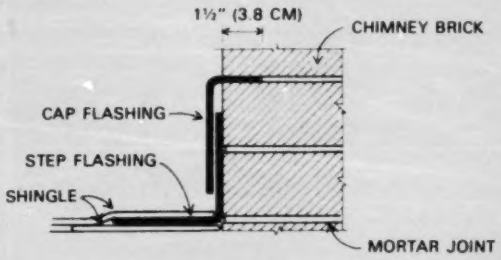



**Fig. 4-20. Application of cap flashing**

One continuous piece of cap flashing is used at the front of the chimney, and several pieces are applied shingle fashion at the sides and back. The side flashing units are started at the lowest point and are overlapped at least 6 inches (15.2 centimetres). (See Figs. 4-21 and 4-22.)

Flashing at vent pipes can be accomplished in several ways. A common method is to apply shingles up to the pipe, then cut a hole in a shingle to go over the pipe and set the shingle in plastic cement. A preformed flashing flange is then pressed over the pipe

**Fig. 4-21. Application of cap flashing at the front and side of a chimney**

and into a bed of cement on the shingle that surrounds the pipe. Finally, the asphalt shingles are continued up the roof slope and around the flashing. (See Figs. 4-23, 4-24, and 4-25.)

**Shingling to a Hip**

When a course of shingles begins or ends at a hip, the shingle nearest the hip should extend beyond the hip far enough so that it can be trimmed off and mitered to the hip line. If the end of the shingle does not quite reach the hip, a small triangular space will remain between the end of the shingle and the hip, and the space will have to be filled with a piece of shingle cut to the same size and shape. This is not considered good roofing practice, since the small filler piece is likely to curl or loosen after a time and become a possible source of a leak.

**Covering Hips and Ridges**

After the shingles on both sides of the roof have been applied up to the ridge or to a hip, these parts of the roof must be covered to make them weatherproof and give the roof a finished appearance. Some shingle manufacturers make special hip and ridge cover units and specify how they should be applied. Hip and ridge coverings may also be made on the job by cutting a three-tab strip shingle into three parts, as shown in Figure 4-26. To apply the hip and ridge caps, the roofer should bend each cap shingle along the center-line so that it will extend an equal distance on each side of the hip or ridge, then nail the caps in place, lapping them so they will have approximately a 5-inch (12.7-centimetre) exposure. The laps on the ridge caps face away from the direction of the prevailing wind;

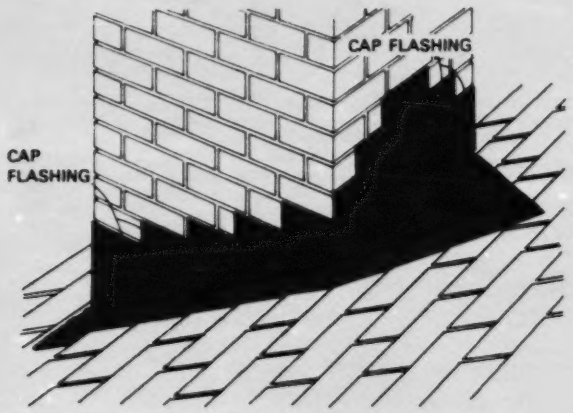



Fig. 4-22. Application of cap flashing at the side and rear of a chimney

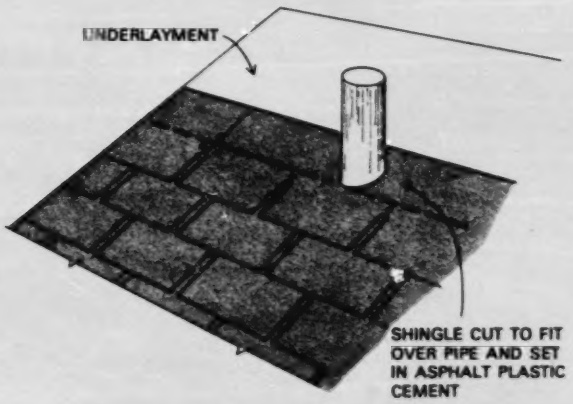



Fig. 4-23. Application of a shingle over a vent pipe

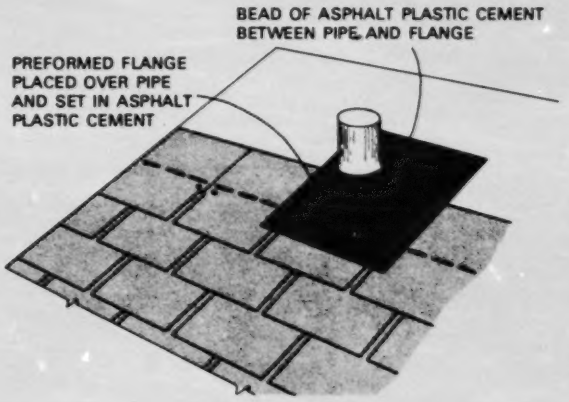

BEAD OF ASPHALT PLASTIC CEMENT BETWEEN PIPE AND FLANGE
PREFORMED FLANGE PLACED OVER PIPE AND SET IN ASPHALT PLASTIC CEMENT

Fig. 4-24. Application of flashing over a vent pipe

UPPER AND SIDE SHINGLES OVERLAP FLANGE AND ARE SET IN ASPHALT PLASTIC CEMENT.
LOWER PART OF FLANGE OVERLAPS LOWER SHINGLES.

Fig. 4-25. Application of shingles around flashing

those on the hip caps face downward so they do not buck water. (See Figs. 4-27 and 4-28.)

### Study Assignment

*Uniform Building Code* (Latest edition). Whittier, Calif.: International Conference of Building Officials. Read the information on asphalt shingles in Section 3203.

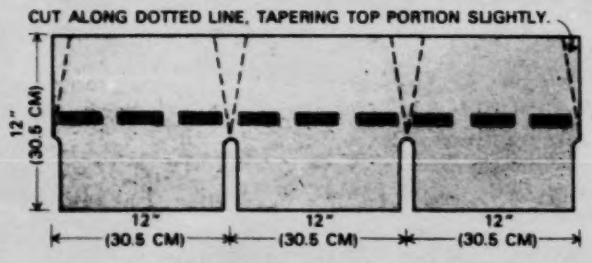



**Fig. 4-26. Cutting hip and ridge caps from a three-tab strip shingle**

**Fig. 4-27. Application of hip and ridge shingles**

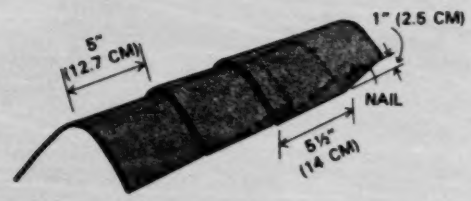



**Fig. 4-28. Nail location for hip and ridge shingles**

## TOPIC 5—REROOFING WITH ASPHALT SHINGLES

This topic and the related instruction classes are designed to enable the apprentice to do the following:

- **Determine whether the old roofing should be torn off before a new asphalt-shingle roof is applied.**
- **Identify the tools and methods used to remove old roofing.**
- **Describe how existing asphalt-shingle, roll-roofing, and wood-shingle roofs are prepared for reroofing with asphalt shingles.**
- **Discuss the flashing details for an asphalt-shingle reroofing job.**
- **Describe a typical procedure for reroofing with asphalt shingles.**

### Preparing the Deck

Asphalt shingles can be installed successfully over almost any type of existing roof. The old roofing material must not be hard or brittle, like tile or slate, since the new roofing nails must penetrate through it and into the sheathing below. It must also provide a reasonably smooth base for the new shingles. An existing asphalt-shingle or wood-shingle roof usually need not be torn off unless the maximum allowable number of roof coverings are already in place or the roof is very badly weathered.

If the old roof would require extensive repair before it could serve as a satisfactory base for the new shingles, or if any doubt exists about the condition of the underlying sheathing, the old roof should be torn off.

#### Removal of the Old Roofing

If the existing roof must be removed, the tear-off operation should be performed as outlined in Topic 3. Flat spades are convenient for stripping off old asphalt or wood shingles, and a small pry bar is helpful for removing pipe jacks and other metal flashings. Old shingles near chimneys, vent pipes, and adjoining walls should be removed carefully to avoid damaging flashing materials that might be reusable. Even if the old flashings are going to be discarded, they should be removed intact if possible, since they can serve as patterns for making new ones. Also, if the metal counterflashing in a chimney or a masonry wall is still in good condition, it should be bent up out of the way so that it can be reused when the base flashing has been replaced.

After the tear-off is completed, all remaining nails should be pulled out or driven down, and then the deck should be swept clean, inspected, and repaired if necessary. Then the reroofing job can proceed.

#### Felt Underlayment

If the old roofing has been torn off, the exposed deck must be covered with felt underlayment before the new asphalt shingles are applied. The deck must be clean and dry before the felt is placed. The usual requirement for roofs of normal slope (4/12 or greater; 4/12 is the most common slope) is a single layer of nonperforated No. 15 felt (No. 30 felt may be required by local codes). In areas where ice may build up along the roof eaves, local codes may call for eaves flashing consisting of an additional layer of felt extending partway up the roof from the eave line, as described in Topic 4.

Felt underlayment usually may be omitted over existing roofing if the roof is of normal slope (4/12 or greater). Asphalt shingles may be installed on slopes as low as 2/12 if they are laid so as to give double coverage (not less than two layers of shingles at any place on the roof), are approved self-sealing or hand-sealed types, and are applied over two layers of No. 15 nonperforated felt. Local codes may have other requirements for low-slope application, particularly where winters are severe.

#### Asphalt Shingles over Asphalt Shingles

When asphalt shingles are to be applied over an existing asphalt-shingle roof, any shingles missing from the old roof should be replaced; and any that are loose, curled, buckled, or broken should be replaced or nailed down. All the old hip and ridge coverings should be removed. Buckled shingles can result from faulty installation, and they can also be caused by protruding nails or warped sheathing boards. Any protruding nails should be hammered down, but if a nail is loose, it should be removed, and a new one should be driven nearby. If no more than a few boards are warped, they may be renailed without stripping off all the old roofing. If many of the old boards are warped, however, complete tear-off may be advisable. Flashings and metal drip edges should be inspected and replaced if necessary.

If the existing asphalt shingles are the interlocking type, they may present an uneven surface, and new

strip shingles applied over them may in time conform to this unevenness. If a smoother base is required, the old interlocking shingles should be removed or a heavier base sheet should be applied.

**Asphalt Shingles over Wood Shingles**

Before asphalt shingles are applied over an existing wood-shingle roof, any loose shingles on the old roof should be renailed, and any that are missing should be replaced. Badly curled or warped shingles should be split and nailed down. Generally, the existing shingles at the eaves and rakes are trimmed flush, and metal edging is installed. However, if the shingles at the eaves and rakes are badly weathered, they should be cut back far enough to permit edging strips of 1 x 4 inch (2.5 x 10.2 centimetre) or 1 x 6 inch (2.5 x 15.2 centimetre) lumber to be nailed in placed at these locations. This edge reinforcement is especially important on a roof that will be subject to high winds. The edging strips should overhang the deck the same distance as the old wood shingles (usually about ¾ inch [1.9 centimetres] at the rakes and the eaves), and they should be protected against water by metal drip edging. (See Fig. 5-1.)

No further preparation of the old roof will usually be necessary if it has a normal slope (4/12 or greater) and presents an adequately smooth base for the new shingles. The smoothness of the roof can be improved by applying felt underlayment over the existing wood shingles (required by some local codes).

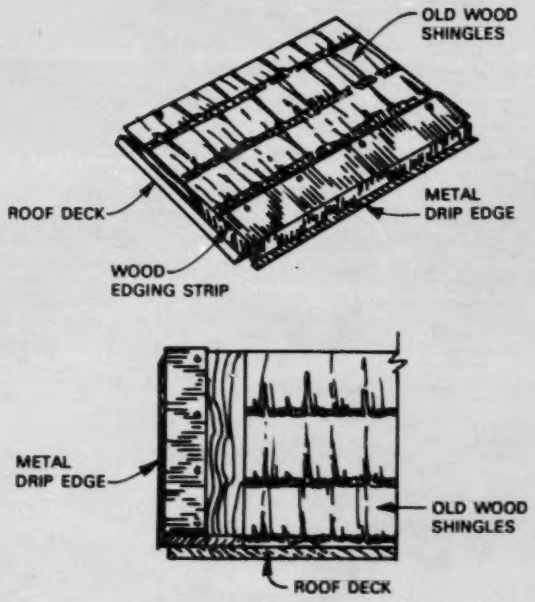



**Fig. 5-1. Application of wood edging strips and metal drip edging**

Because of their irregular surfaces, wood-shake roofs are generally considered to be unacceptable as a base for new shingles.

**Asphalt Shingles over Roll Roofing**

Asphalt shingles can be installed over roll roofing if the roof has enough slope and the old roofing is not badly weathered. Any buckles or blisters in the roll roofing should be cut through and nailed down flat, and any lap joints that have separated should also be nailed down. Damaged or worn places in the old roofing should be trimmed out to a square or rectangle, then patched with a new piece of roofing cut to the same size and shape. Before the patch is nailed in place, the exposed sheathing should be inspected for defects of the type described in Topic 3.

Roll roofing is often used on roofs of very low slope (as little as 1/12), whereas the minimum slope for standard application of asphalt shingles is 4/12. Asphalt shingles may be used on slopes lower than 4/12, but only if special application procedures are followed, as noted earlier in this topic. The manufacturers of asphalt shingles provide detailed instructions for the use of their products on low-slope roofs.

## Applying the Shingles

The method used to apply asphalt shingles on a reroofing job depends on the type of shingles selected for the job and whether the old roofing material will be torn off or left in place. If the old roof is removed down to the deck, or if it consists of roll roofing or built-up roofing that can be left in place, the shingles can be applied by any of the methods described for new construction in Topic 4.

The asphalt shingles most often used in residential reroofing are three-tab strip shingles. When applying new asphalt strip shingles over an existing strip-shingle roof, some roofers prefer to use the "butt-up" method, in which the new shingles are placed with their top edges positioned against the butts of the old shingles. (See Fig. 5-2.) The butt-up method simplifies horizontal alignment of the new shingles (provided that the alignment and exposure of the old shingles are correct), and it produces a smoother reroofing job because the head laps of the new shingles do not occur directly above those of the old shingles.

The reroofing procedure that follows in this topic is for three-tab strip shingles applied by the butt-up method over an existing strip-shingle roof. Information on reroofing with other types of asphalt strip shingles, interlocking shingles, and large individual shingles can be found in industry publications like those listed in the Instructional Materials section on page 50 of this workbook.

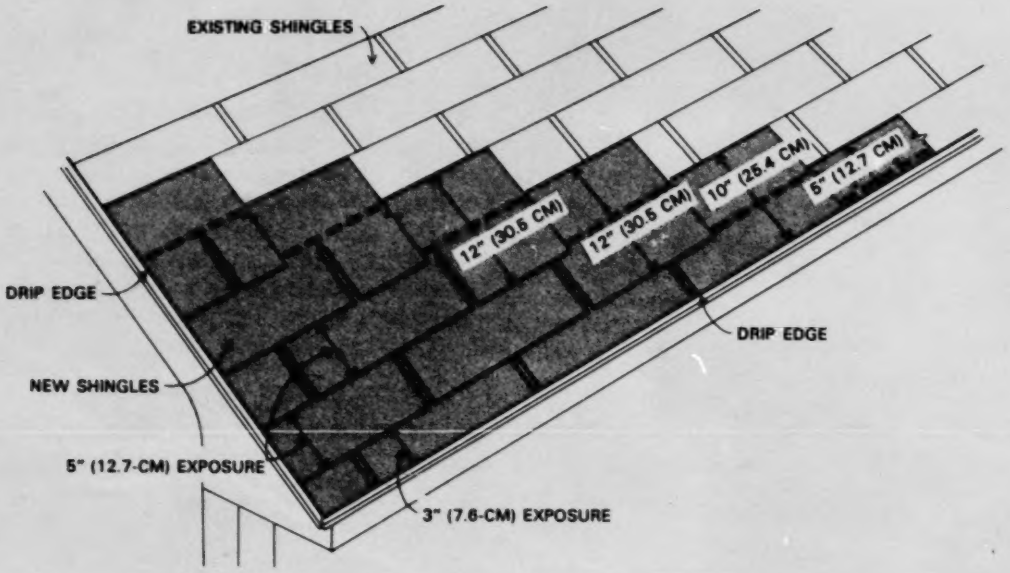



**Fig. 5-2. Butt-up application of three-tab strip shingles**

### Applying the Starter Course

The first step in recovering an existing strip-shingle roof is to install a starter course of trimmed shingles, beginning at the rake and extending along the eaves. The shingles for the starter course are prepared by cutting off the tabs, then cutting away a portion of the top edge so that the width of the trimmed shingle is equal to the exposure of the shingles on the existing roof. (*NOTE:* The cut-off tabs should be saved for possible use at the ridge.) If the old roof was shingled with a 5-inch (12.7-centimetre) exposure, the starter course will extend 5 inches (12.7 centimetres) up from the drip edge to the butts of the existing first course, as shown in Figure 5-2. The old shingles at the eaves should overhang the drip edge enough to carry water into the gutter; if they do not, or if they are badly weathered at the edges, the width of the starter course should be increased slightly to provide the necessary overhang (normally about ¾ inch [1.9 centimetres]).

To ensure that the joints in the starter course will be covered when the first course of new shingles is laid, 3 inches (7.6 centimetres) should be trimmed off the rake end of the first starter-course shingle. Also, if the shingles used for the starter course are the self-sealing type, they should be placed so that the factory-applied adhesive is along the lower edge, as shown in Figure 5-2. The nails used to fasten the starter strip should be positioned so that they are not under the cutouts of the first course of new shingles.

### Applying the First Course

The shingles for the first course should be trimmed off at the top enough so that they are the same width as the distance from the butts of the existing third course to the lower edge of the starter strip. On a roof with a 5-inch (12.7-centimetre) exposure, the trimmed width of the shingles for the first course will be 10 inches (25.4 centimetres), as shown in Figure 5-2. Full-width shingles are used in the second course, and this reduces the exposure of the first course to 3 inches (7.6 centimetres). This is not considered objectionable, however, since the first course is partially concealed by the gutter.

Application of the first course should start at the rake with a full-length shingle. Four nails are generally used to fasten the new shingles; they are placed as shown in Figure 4-12 in Topic 4. As in new construction six nails may be required for each shingle if the roof must withstand high winds. The nails must be long enough to penetrate through the old shingles and ¾ inch (1.9 centimetres) into the sheathing. Nails near the eave and rake overhangs should not be so long that they project through the exposed sheathing.

### Applying the Remaining Courses

Full-width shingles are used for the remaining courses. They are usually applied in staircase fashion, across and diagonally up the roof, by one of the methods described for new construction in Topic 4. The top edges of the new shingles in each course are positioned against the butts of the old shingles in the course above. The second course and all the remaining courses up to the ridge will automatically be in correct horizontal alignment (assuming that the old shingles are correctly aligned), and the new shingles will have the same exposure as the old ones. With the

butt-up method, the only shingles that must be gaged to obtain the correct alignment and exposure are the last two courses at the ridge. Also, some excess material will have to be trimmed off the top of the final course at the ridgeline.

When both slopes of the roof have been shingled up to the ridge, the ridge cover units can be applied as in new construction. Hip treatments are also the same as in new work. (See Figs. 4-27 and 4-28 in Topic 4.)

**Applying the Flashings**

If the reroofing job requires that the old roof be removed, the flashing details will be essentially the same as for new construction. Old metal flashings that are still serviceable may be left in place and reused. The treatment of the flashings will differ somewhat if the new shingles are to be installed over an existing roof. For example, if an old asphalt-shingle roof that is to be reshingled has a smooth, open valley, the valley should be built up flush with the shingles with a filler strip of No. 90 mineral-surfaced roll roofing. Then a new length of flashing, wide enough to overlap the existing shingles on both sides of the valley, should be installed over the valley in the same manner as flashing for new construction. An alternate treatment for an old open valley is to install the filler strip, then construct a woven valley or a closed-cut valley over the strip.

On a recover job over existing asphalt shingles, flashing against a vertical sidewall is accomplished by trimming the new asphalt shingles to within ¼ inch (0.6 centimetre) of the existing step flashing, then embedding the last 3 inches (7.6 centimetres) of the trimmed shingles in plastic cement. Finally, a bead of the plastic cement is applied with a caulking gun along the joint where the new shingles meet the sidewall. Flashing at a vertical sidewall is done in essentially the same way when new asphalt shingles are applied over an old wood-shingle roof, except that a strip of smooth, heavy-base roll roofing 6 to 8 inches (15.2 to 20.3 centimetres) wide is first nailed over the wood shingles where they adjoin the wall, as shown in Figure 5-3.

Flashings around soil stacks, vent pipes, chimneys, and other projections through the roof are common sources of leaks. Any of these flashings that are found to be deteriorated should be removed and replaced with new material. Also, if an old chimney does not have a cricket to divert water away from the back face, the recommended practice is to remove the old flashing, regardless of its condition, and install a cricket before reflashing the chimney.

If the flashing around a soil stack or vent pipe is still in serviceable condition, the sheet-metal flange should be pried up at the down-slope end so that the new shingles can be laid under it. (A heated putty knife can be used to help separate the cemented-down flange from the old roofing.) Before the flange is set back in place, the area beneath it should be covered with plastic cement. As few nails as possible should be used to refasten the flange, and none should be driven close to the pipe. Nail locations should be chosen so that the nail heads will be covered when the shingling around the vent is completed. (See Fig. 5-4.) An additional bead of plastic cement should be applied around the pipe at the joint between the pipe and the flange. The procedure for continuing the shingles up the roof and

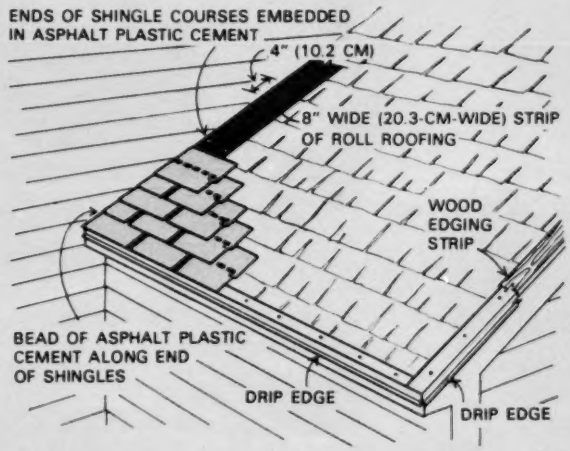

ENDS OF SHINGLE COURSES EMBEDDED IN ASPHALT PLASTIC CEMENT
4" (10.2 CM)
8" WIDE (20.3-CM-WIDE) STRIP OF ROLL ROOFING
WOOD EDGING STRIP
BEAD OF ASPHALT PLASTIC CEMENT ALONG END OF SHINGLES
DRIP EDGE
DRIP EDGE

**Fig. 5-3. Application of flashing against an adjoining vertical wall (reroofing over wood shingles)**

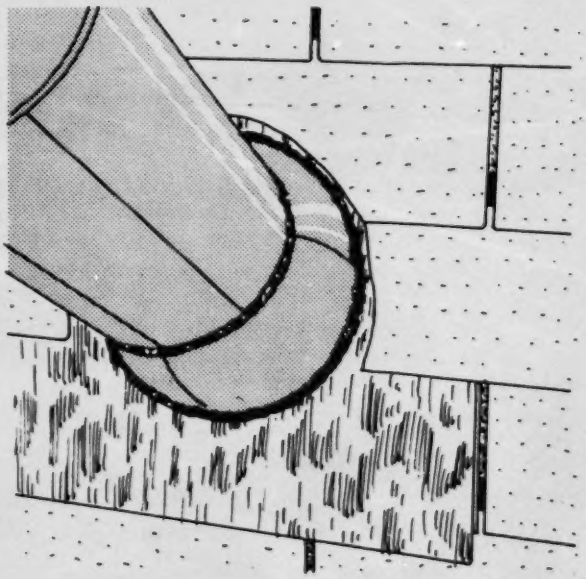


**Fig. 5-4. Application of flashing at a vent pipe on a strip-shingle roof**

around the pipe or vent is essentially the same as for new construction.

If the existing flashings around a chimney are in good condition, the lower part of the base flashing at the front of the chimney should be lifted up so that the new shingles can be installed under it. The area under the base flashing should be covered with plastic cement before the flashing is put back. As the reshingling operation proceeds up the roof, the new shingles at the sides and back of the chimney should be trimmed to within ¼ inch (0.6 centimetre) of the existing flashing and embedded in asphalt cement, as in the procedure described earlier for flashing against a vertical wall. Finally, a bead of plastic cement should be applied along the joint between the new shingles and the metal flashing.

### Study Assignments

1. Obtain and read industry publications that contain model specifications and application procedures for reroofing with various types of asphalt shingles.
2. Review the safety information in Topic 2 of this workbook.

## ASPHALT AND WOOD SHINGLING

## TOPIC 6—APPLICATION OF ROLL ROOFING

This topic and the related instruction classes are designed to enable the apprentice to do the following:

- **Identify typical roll-roofing products.**
- **Explain why roll-roofing products and asphalt cements should be stored in a warm place until they are needed.**
- **Distinguish between the exposed-nailing and concealed-nailing methods of applying roll roofing.**
- **Describe the procedures for applying single-coverage roll roofing parallel to the eaves and parallel to the rakes.**
- **Identify the procedures for applying double-coverage roll roofing parallel to the eaves and parallel to the rakes.**
- **Discuss the methods and materials used to finish the hips and ridges on single-coverage and double-coverage roll-roofing jobs.**

### Types of Roll Roofing and Application Methods

Asphalt roll roofing is produced in rolls 36 inches (91.4 centimetres) wide and approximately 36 feet (11 metres) long, smooth surfaced or coated on all or part of one side with mineral granules, and in weights ranging from 40 to 90 pounds (18.1 to 40.8 kilograms) per roll. (See Table 1-3 in Topic 1.) It may be applied single or double coverage on slopes as low as 1/12. Single-coverage roll roofing is applied with a 2- to 4-inch (5.1- to 10.2-centimetre) overlap, and the granule-coated roll material may have a granule-free selvage edge the same width as the recommended overlap. Double-coverage roll roofing (also called split sheet) has a 19-inch (48.3-centimetre) granule-free selvage edge and is applied with a 19-inch (48.3-centimetre) overlap. Single-coverage roll roofing is also used as a flashing material, as described in Topic 4.

Roll roofing is usually applied with the sheets running parallel to the eaves, but application parallel to the rakes is also acceptable. The latter may be the easier method on a steep roof. Either concealed or exposed nailing may be used to apply single-coverage roll roofing, but if exposed nailing is used, the slope must not be less than 2/12. Concealed nailing is required with double-coverage material, and it is recommended for any roll-roofing job where best appearance and maximum service life are important considerations. Plastic asphalt cement is used to seal the horizontal and vertical laps in single-coverage roll roofing; hot-mopped asphalt is commonly used for this purpose in double-coverage application.

The application procedures described in this topic are intended for general information only. On an actual job the procedures recommended by the manufacturer of the roll-roofing material should be followed. Roll-roofing jobs must also conform to all applicable building code requirements.

#### Preliminary Work

The deck must be clean and dry before roll roofing is applied. If an existing roof is to be recovered with roll roofing, the roof should be prepared as for asphalt strip shingles, as described in Topic 4. The rolls should be stored on end in a warm place until they are to be used; at temperatures below 45° F. (7.2° C), the mineral coating may crack when the material is unrolled. Also, roll roofing that is applied cold will expand slightly and tend to buckle after it has been warmed by the sun. If roll roofing must be applied in cold weather, it should be cut into 12- to 18-foot (3.7- to 5.5-metre) lengths, then spread out in a pile on a flat surface, preferably in the sun, and allowed to flatten before it is installed.

### Single-Coverage Application Parallel to the Eaves, Using the Exposed-Nailing Method

The general procedure for installing single-coverage roll roofing parallel to the eaves by the exposed-nailing method is illustrated in Figure 6-1. A plywood deck is shown in the drawing, but roll roofing may also be installed over tight lumber sheathing or any other smooth, firm, and continuous base that is nailable. Good roofing practice calls for the use of felt underlayment, and metal drip edging should be installed. Roll roofing should never be cemented directly to the sheathing; normal movements that occur in the deck joints could cause the tightly bonded roofing material to buckle or crack. If the roof has

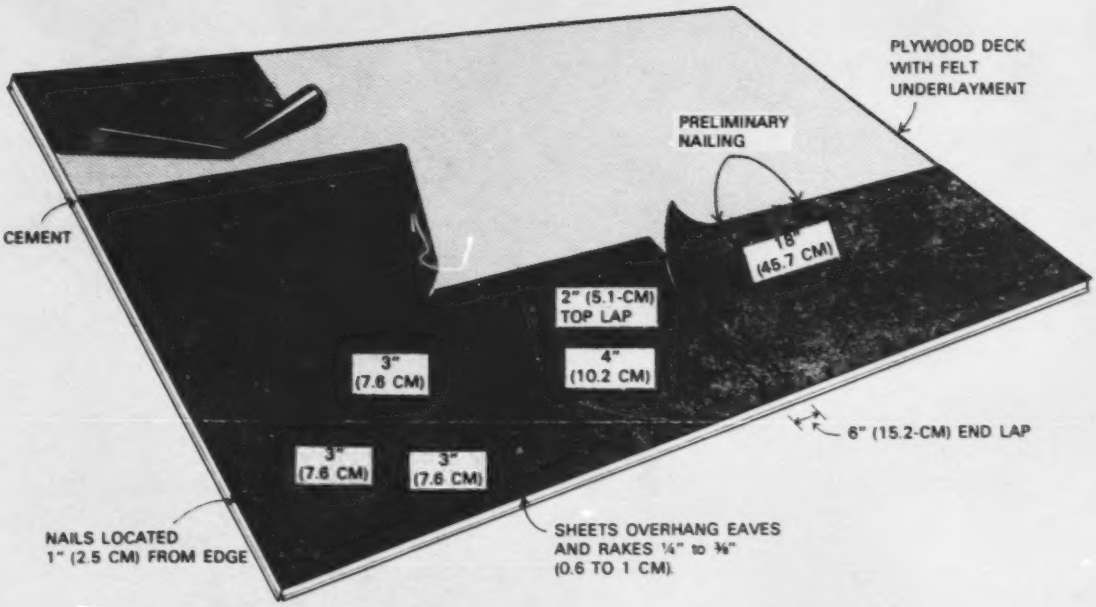

PLYWOOD DECK WITH FELT UNDERLAYMENT
PRELIMINARY NAILING
CEMENT
18" (45.7 CM)
2" (5.1-CM) TOP LAP
4" (10.2 CM)
3" (7.6 CM)
6" (15.2-CM) END LAP
3" (7.6 CM)
3" (7.6 CM)
NAILS LOCATED 1" (2.5 CM) FROM EDGE
SHEETS OVERHANG EAVES AND RAKES ¼" to ⅜" (0.6 TO 1 CM).

**Fig. 6-1. Exposed-nail method of applying roll roofing parallel to the eaves**

valleys, open-valley construction should be used, with appropriate flashing. (See "Flashing a Valley" in Topic 4.)

Roll roofing may also be used to recover an existing roof if the old roof is nailable and reasonably smooth. The nails used to fasten the roll material must be long enough to penetrate through the old roofing and at least ¾ inch (1.9 centimetres) into the sheathing. Extra care should be taken in nailing through existing roofing materials to avoid overdriving the nails and damaging the roll roofing. As in new work nails in the eave and rake areas should not penetrate through the exposed underside of the sheathing.

### Applying the First Course

The first course is a full-width sheet of roll roofing placed so that it overhangs the eaves and rakes ¼ to ⅜ inch (0.6 to 1 centimetre). Nailing should begin on a line ½ to ¾ inch (1.3 to 1.9 centimetres) below the top edge of the sheet, with the nails spaced 18 to 20 inches (45.7 to 50.8 centimetres) apart. This preliminary top nailing holds the sheet in place until the second course is lapped over it and nailed. Nails at the eaves and rakes should be located on a line 1 inch (2.5 centimetres) from the edge of the roofing and spaced 3 inches (7.6 centimetres) on centers. The nails along the eaves should be staggered slightly to avoid splitting the sheathing, and they should not be so long that they project through the exposed underside of the sheathing.

If a course of roll roofing must be joined with an end lap to obtain the necessary length, the lap should be 6 inches (15.2 centimetres) wide, sealed with plastic cement, and stagger-nailed as shown in Figure 6-1. The cement should extend the full width of the lap, but it should not be applied so thickly that it flows out of the joint when the overlap is nailed down. In cool weather the cement may have to be warmed so that it will spread easily; this can be done by placing the container in hot water. *A torch or other open flame must never be used for this purpose.* Also, the cement should never be thinned with any kind of solvent.

### Applying the Second and Following Courses

The second course should be positioned so that it overlaps the first by 2 inches (5.1 centimetres), then fastened along the top edge with preliminary nailing in the same way as the first course. The lap joint should be sealed with a full-width coating of plastic cement and fastened with nails spaced 3 inches (7.6 centimetres) on centers. The nails should be slightly staggered but kept within the width of the overlap; no nail should be closer then ¾ inch (1.9 centimetres) to the edge of the lap. The rake edges should be nailed the same way as in the first course. If an end lap is required in the second course, it should be staggered so that it is not in line with an end lap in the preceding course.

The procedure is repeated for all other courses needed to cover the roof.

### Covering Hips and Ridges

Where roll roofing meets a hip or ridge, the roll roofing is trimmed to the centerline of the hip or ridge and nailed down. The roll roofing on the adjoining

slope is trimmed to the centerline and nailed in the same manner. (See Fig. 6-2.) Next, a strip of roll roofing 12 inches (30.5 centimetres) wide is bent lengthwise along its center to form a cover for the hip or ridge, as shown in the illustration. In cold weather the strip should be warmed before it is bent. A band of plastic cement 2 inches (5.2 centimetres) wide should be spread along each side of the hip or ridge, with the outer edge of each band on a line 5½ inches (14 centimetres) from the center of the hip or ridge. The cover strip should then be placed over the hip or ridge and pressed into the bands of cement. The strip should be fastened on each side with a row of nails ¾ inch (1.9 centimetres) in from the edge and spaced 3 inches (7.6 centimetres) on centers. The nails should penetrate the cemented zone underneath the strip; this will seal the nail holes with asphalt.

The hip or ridge cover usually consists of a single strip of roll roofing. If more than one piece is used to make the cover, the pieces should be joined with a fully cemented 6-inch (15.2-centimetre) end lap.

### Single-Coverage Application Parallel to the Eaves, Using the Concealed-Nailing Method

The first step in applying roll roofing by the concealed-nailing method is to nail down a layer of roofing felt on the deck. Full-width courses of roll roofing are then installed in basically the same way as with exposed nailing, except that the sheets are nailed at the top only. The nails at the top of each sheet are concealed by the overlap when the next course is placed. All laps are cemented, and the sheets are cemented to the deck at the eave and rake edges. (See Fig. 6-3.)

#### Applying the First Course

The first course of roll roofing applied by the concealed-nailing method is installed with the bottom edge and ends of the sheet overhanging the eaves and the rakes about ¼ to ⅜ inch (0.6 to 1 centimetre). The top edge of the sheet is fastened to the deck with staggered nails spaced 4 inches (10.2 centimetres) on centers, as shown in Figure 6-3. (The nails within 18 inches [45.7 centimetres] of the rake edges are omitted until the sheet has been cemented to the rakes.) The lower edge of the first course should then be turned back so that a continuous band of plastic cement about 6 inches (15.2 centimetres) wide can be applied over the entire length of the eaves. Next, the sheet should be laid back over the cemented eaves, and the ends of the sheet should be lifted so that beads of cement can be applied to the rakes. The ends and lower edge of the sheet should then be pressed firmly into the cement, and the nailing along the top edge should be completed out to the edges of the rakes.

If more than one piece of roofing is needed to complete a course, the pieces should be joined with a 6-inch (15.2-centimetre) end lap. The underlying portion of the lap should be stagger-nailed to the deck and coated with plastic cement over its entire area, as shown in Figure 6-3. The overlap should then be pressed firmly into the cement.

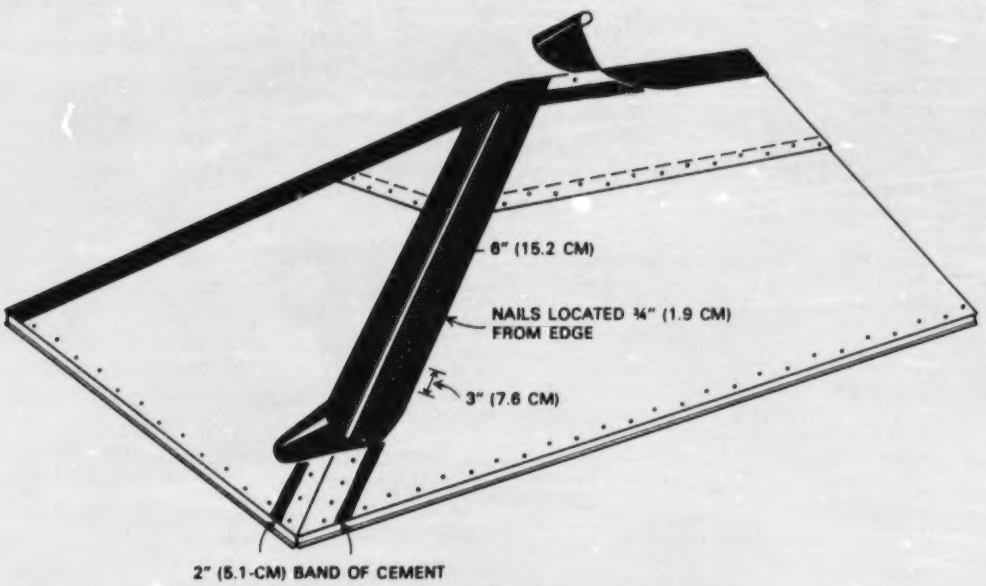



**Fig. 6-2. Exposed-nail method of applying roll roofing to hips and ridges**

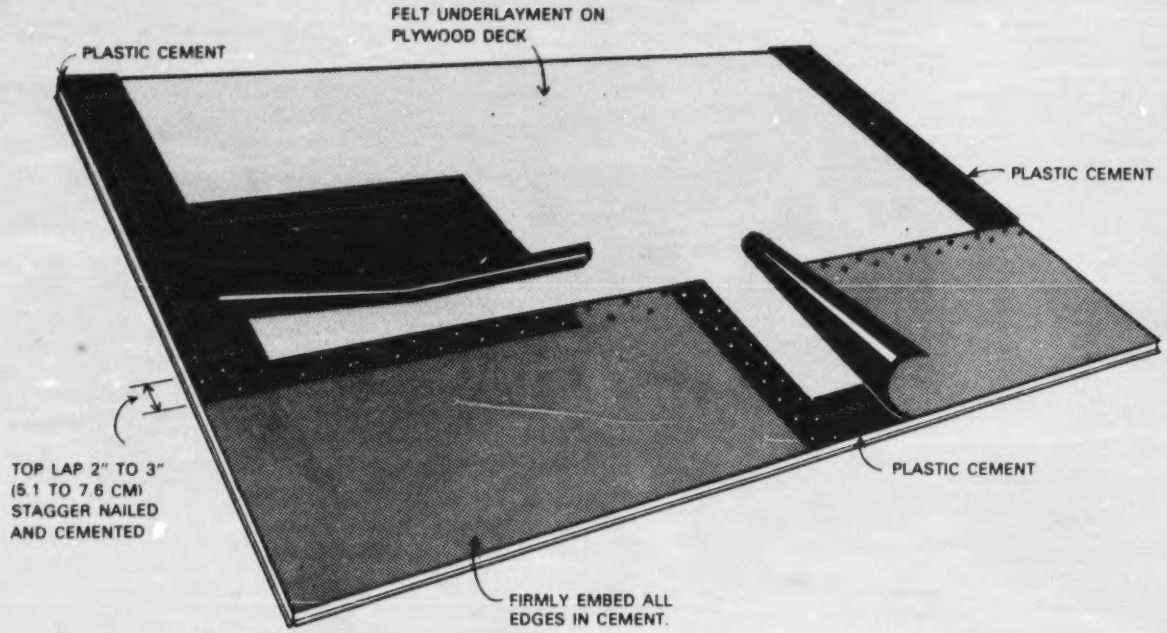

FELT UNDERLAYMENT ON PLYWOOD DECK
PLASTIC CEMENT
PLASTIC CEMENT
TOP LAP 2" TO 3" (5.1 TO 7.6 CM) STAGGER NAILED AND CEMENTED
PLASTIC CEMENT
FIRMLY EMBED ALL EDGES IN CEMENT.

**Fig. 6-3. Concealed-nail method of applying roll roofing parallel to the eaves**

### Applying the Second and Following Courses

The second and following courses should be cut to the required length and positioned so that they overlap the preceding course 2 to 3 inches (5.1 to 7.6 centimetres). They should overhang the rakes about ¼ to ⅜ inch (0.6 to 1 centimetre). The sheets should be nailed along the top edge only and then cemented at the lap, as in the first course. All end laps should be staggered. The same procedure is used to apply the remaining courses.

Where the roll roofing meets a hip or a ridge, it should be trimmed to the centerline of the hip or ridge and nailed as in the exposed-nailing method of application described earlier in this topic.

### Covering Hips and Ridges

The concealed-nailing method of covering hips and ridges is illustrated in Figure 6-4. Strips of roll roofing are cut 12 inches (30.5 centimetres) wide and 36 inches (91.4 centimetres) long, then bent lengthwise along their centers so that they conform to the hip or ridge angle. Each strip is bonded to the roll roofing on both sides of the hip or ridge with bands of plastic cement 5½ inches (14 centimetres) wide, then fastened at the top end with only two nails, which will be concealed by the next overlapping strip. The end laps should be 6 inches (15.2 centimetres) long and fully cemented.

Application of the hip cover strips should begin at the bottom of the hip so that the lap joints will not buck water. The ridge cover strips should start at the end of the ridge that is away from the direction of the prevailing winds.

## Single-Coverage Application Parallel to the Rakes, Using the Exposed-Nailing Method

When roll roofing is installed parallel to the rakes, the sheets are applied vertically from the ridge down, and nailing begins at the ridge. (See Fig. 6-5.) After a sheet has been fastened at the ridge, it should be allowed to hang free on the deck until it lies flat. It should then be nailed on the remaining edges. The sheets will flatten quickly if they are exposed to the sun. Cold-weather application of roll roofing is not recommended, but if it cannot be avoided, the rolls must be kept in a warm place until they are to be used.

### Applying the First Course

The first course is positioned so that it overhangs the rake and the eaves ¼ to ⅜ inch (0.6 to 1 centimetre), then secured at the ridge with three or four equally spaced nails on a line ½ to ¾ inch (1.3 to 1.9 centimetres) below the top of the sheet. After the sheet has been smoothed in place, it is fastened along the vertical lap edge with nails spaced approximately 18 inches (45.7 centimetres) on centers and set in ½ to ¾ inch (1.3 to 1.9 centimetres) from the edge. Then the rake and eaves edges of the sheet are fastened with nails spaced 3 inches (7.6 centimetres) on centers and set in 1 inch (2.5 centimetres) from the edge of the roof. The nails at the eaves edges should be slightly

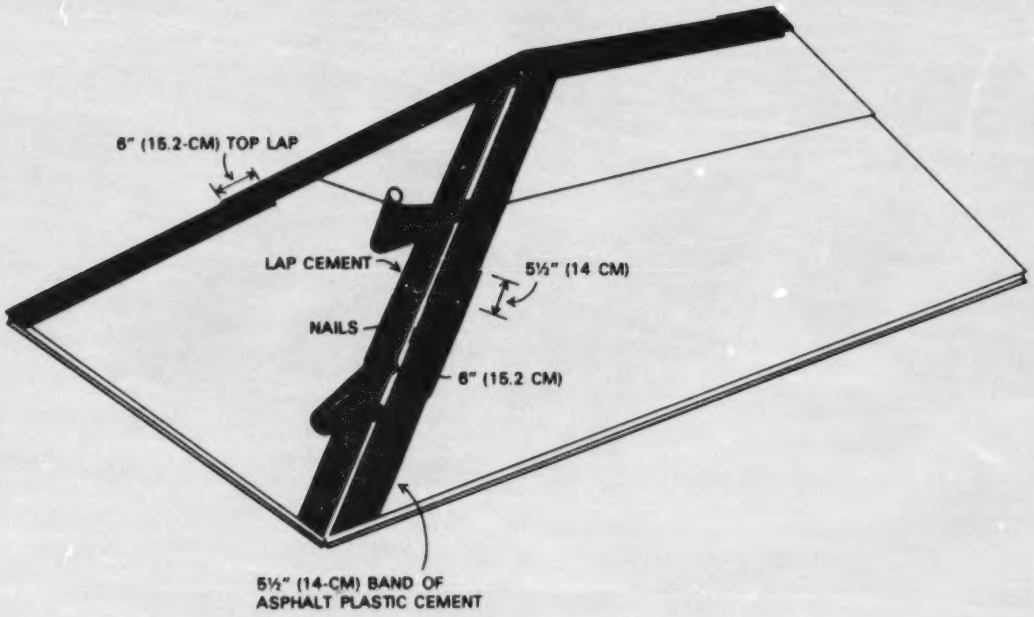



**Fig. 6-4. Concealed-nail method of applying roll roofing to hips and ridges**

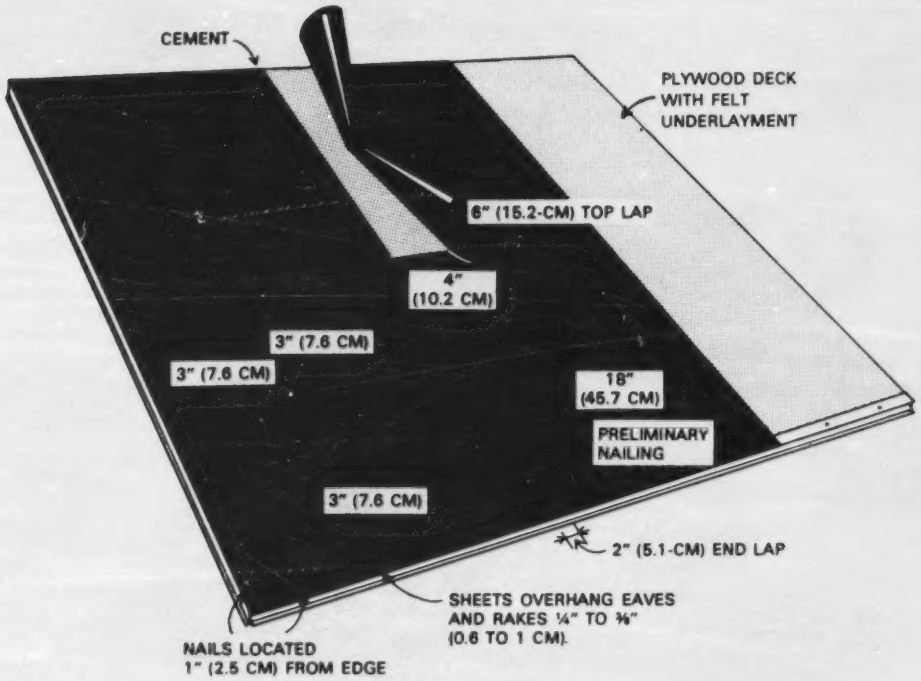



**Fig. 6-5. Exposed-nail method of applying roll roofing parallel to the rake**

staggered. If more than one piece of roll roofing is needed to finish the course, the pieces should be joined with a 6-inch (15.2-centimetre) lap, as shown in Figure 6-5.

#### Applying the Second and Following Courses

The second course is placed so that it overlaps the first course 2 inches (5.1 centimetres). It is fastened in the same way as the first course, except that the lap joint is cemented before it is nailed. The overlap is pressed firmly into the cement, then fastened with nails spaced 3 inches (7.6 centimetres) on centers and set in ¾ inch (1.9 centimetres) from the edge of the sheet. All the following courses are applied in the same way. The top laps in adjoining courses should be staggered.

#### Covering Hips and Ridges

When roll roofing is applied parallel to the rakes with exposed nailing, the hips and ridges are finished in the same way as in application parallel to the eaves. (See Fig. 6-2.)

### Single-Coverage Application Parallel to the Rakes, Using the Concealed-Nailing Method

Except that the sheets are applied vertically from the ridge, application of single-coverage roll roofing parallel to the rakes with concealed nailing is the same as concealed-nailing application parallel to the eaves. Hip treatment and ridge treatment are also the same for both methods. (See Figs. 6-3 and 6-4.)

### Double-Coverage Application Parallel to the Eaves

For double-coverage application of roll roofing, the courses are overlapped on slightly more than half their width so that no part of the deck is covered with fewer than two layers of roofing. Concealed nailing is used throughout, and the lap joints are sealed with solid moppings of hot asphalt. Some roll-roofing specifications may allow cold-applied asphalt cement to be used for sealing the laps. The wide overlap and resulting two-ply construction make a durable weathertight roof covering that can be used on slopes as low as 1/12. Any type of roll roofing may be installed this way, but the material most often used is 19-inch-selvage (48.3-centimetre-selvage) roll roofing (also called double-coverage roll roofing or split sheet). The 19-inch (48.3-centimetre) selvage portion of double-coverage roll roofing is smooth surfaced, since it will be covered by the overlap of the next course; the 17-inch (43.2-centimetre) exposed portion is coated with mineral granules. (See Table 1-3 in Topic 1.)

Before starting a double-coverage roll-roofing job, the roofer should prepare the deck and install flashings and metal drip edges as in single-coverage application. A slip sheet should be nailed down to keep the hot asphalt from bonding the roll roofing to the deck. If the roof has valleys, they should be the open type. (See "Flashing a Valley" in Topic 4.) Low-slope roofs must have no low spots that could collect water; minor depressions can usually be built up satisfactorily with additional roofing material or insulation, but a sagging roof will probably require structural repairs to ensure adequate drainage.

As in all roll-roofing jobs, the roofing materials should be kept in a warm place until they are to be used, and cold-weather application should be avoided if possible.

#### Applying the Starter Strip

The procedure for applying double-coverage roll roofing parallel to the eaves is illustrated in Figure 6-6. First, a starter strip 19 inches (48.3 centimetres) wide is obtained by cutting the selvage portion from a sheet of the roll roofing, and the strip is then nailed in place so that it overhangs the eave and rake drip edges by ¼ to ⅜ inch (0.6 to 1 centimetre). (The mineral-surfaced portion of the sheet should be saved for use at the ridge.) The starter strip should be fastened to the deck with two rows of nails, one row on a line 4¾ inches (12.1 centimetres) below the top edge of the strip and the other on a line 1 inch (2.5 centimetres) above the bottom edge. The nails should be spaced 12 inches (30.5 centimetres) on centers and staggered from row to row.

#### Applying the First Course

After the starter strip has been nailed in place, the entire surface of the strip should be covered with a uniform but not overly thick mopping of hot asphalt. Only enough asphalt should be used to ensure that (1) a continuous, weathertight bond exists between the strip and the overlapping first course; and (2) felt does not touch felt.

The first course is a full-width sheet of double-coverage roll roofing positioned so that the granule-surfaced portion is directly over the starter strip and flush with the lower edge and ends of the strip, as shown in Figure 6-6. The sheet is smoothed in place and fastened to the deck with two rows of nails in the selvage portion, the first row on a line 4¾ inches (12.1 centimetres) below the top edge and the second row 8½ inches (21.6 centimetres) below the first. The nails should be spaced 12 inches (30.5 centimetres) on centers and staggered from row to row. The overlapping portion of the sheet is then pressed firmly into the hot asphalt on the starter strip. Pressure should be applied over the entire lap to ensure complete bonding.

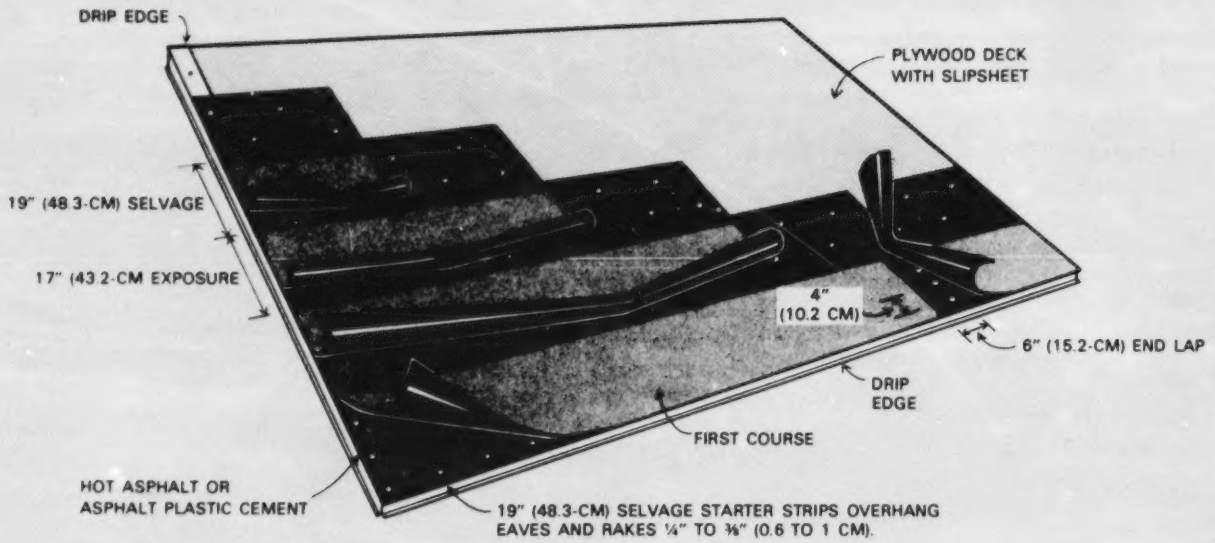

DRIP EDGE
PLYWOOD DECK WITH SLIPSHEET
19" (48.3-CM) SELVAGE
17" (43.2-CM EXPOSURE
4" (10.2 CM)
6" (15.2-CM) END LAP
DRIP EDGE
FIRST COURSE
HOT ASPHALT OR ASPHALT PLASTIC CEMENT
19" (48.3-CM) SELVAGE STARTER STRIPS OVERHANG EAVES AND RAKES ¼" TO ⅜" (0.6 TO 1 CM).

**Fig. 6-6. Application of double-coverage roll roofing parallel to the eaves**

If end laps are required, they should be made 6 inches (15.2 centimetres) wide. The underlying granule-surfaced portion of the lap is fastened to the deck with a row of nails spaced 4 inches (10.2 centimetres) on centers and located 1 inch (2.5 centimetres) from the edge. Then the entire lap area, including the selvage portion, is coated with hot asphalt. The overlying sheet is then pressed into the mopped asphalt, and the selvage portion of the completed lap is nailed to the deck. End laps in successive courses should be staggered.

### Applying the Second and Following Courses

The second course is positioned so that it overlaps the entire 19-inch (48.3-centimetre) selvage portion of the first course. The selvage of the second course is then nailed in the same way as that of the first course, and the sheet is turned back so that the selvage of the first course can be coated with hot asphalt. The mopping should cover the entire selvage area except the last ¼ inch (0.6 centimetre) next to the granules. Again, excessive use of hot asphalt should be avoided; if the proper amount is used, a good bond will result, and the asphalt will spread out to fill the last ¼ inch (0.6 centimetre) of the joint when the overlap is pressed down. The second course should be smoothed back over the first course and pressed into the mopped asphalt.

The third course and all the remaining courses up to the ridge are applied in the same way. Any excess selvage on the last course is trimmed off at the ridgeline, and the granule-surfaced piece that was removed to make the starter strip is then trimmed to fit over the selvage portion of the ridge course and cemented in place.

### Covering Hips and Ridges

Where double-coverage roll roofing meets a hip or a ridge, the sheets are trimmed, butted, and nailed in the same way as for single-coverage material. Hips and ridges are covered with strips 12 inches (30.5 centimetres) wide and 36 inches (91.4 centimetres) long that are obtained by cutting across the full width of a sheet of double-coverage roll roofing. The strips are bent down along their centerlines so they will cover 6 inches (15.2 centimetres) on each side of the joint. They are applied shingle fashion, beginning at the lower end of the hip and at the end of the ridge that is away from the direction of the prevailing winds. (See Fig. 6-7.)

The selvage portion of one of the strips is cut off for use as a starter, and the remaining granule-surfaced portion is set aside for use at the other end of the hip or ridge. The starter strip is fastened with nails located 1 inch (2.5 centimetres) from each edge and spaced 4 inches (10.2 centimetres) on centers, and it is then completely coated with hot asphalt. The first full-length strip is then fitted over the starter strip, pressed firmly into the asphalt, and nailed along each edge of the selvage portion. The selvage is coated with hot asphalt in preparation for the next strip, and the process is repeated until the entire length of the hip or ridge has been covered.

### Double-Coverage Application Parallel to the Rakes

Vertical application of double-coverage roll roofing is begun by nailing a 19-inch-wide (48.3-centimetre-wide) starter strip along the rake, using the same procedures as in horizontal application. (See Fig. 6-8.) The starter strip is coated with hot asphalt, and the first course is then positioned over it and smoothed in place. The overlapping portion of the sheet is pressed firmly into the hot asphalt on the starter strip, and the selvage portion is fastened to the deck with two staggered rows of nails. If end laps are required within the

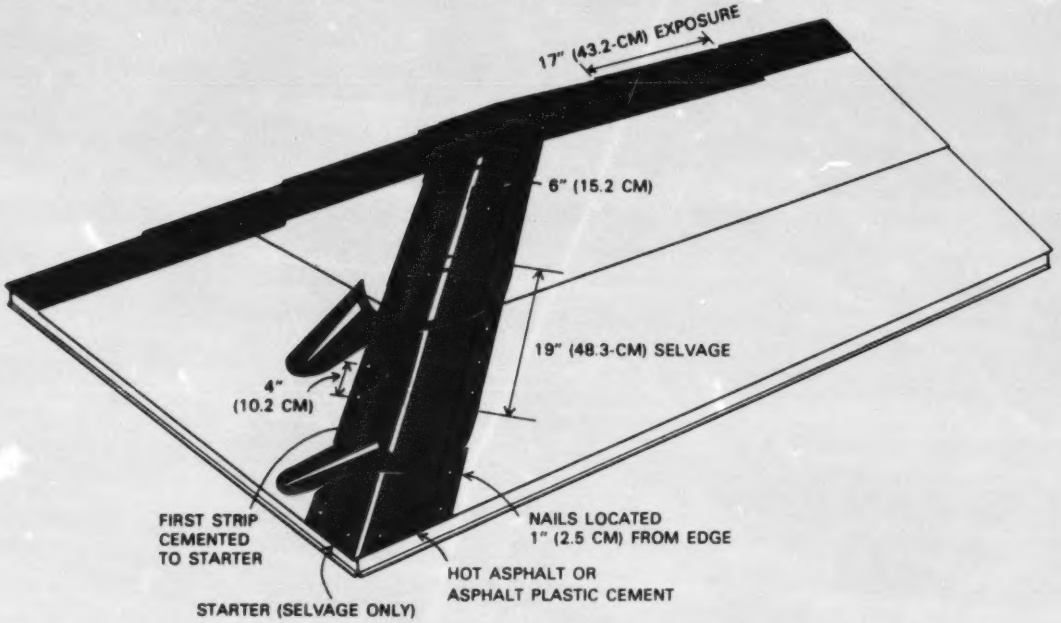



**Fig. 6-7. Application of double-coverage roll roofing to hips and ridges**

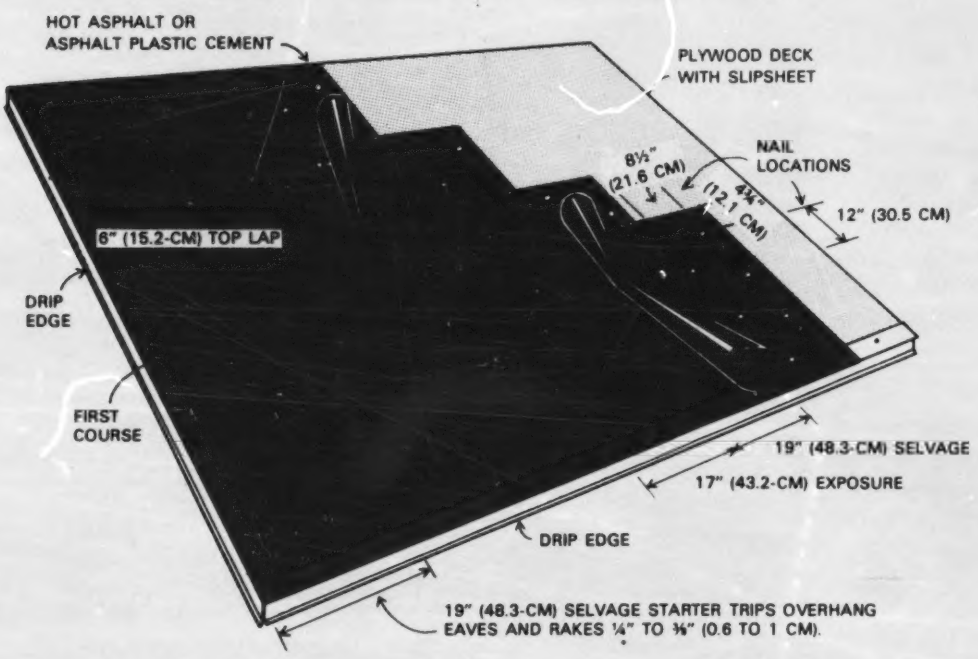



**Fig. 6-8. Application of double-coverage roll roofing parallel to the rake**

course they are made 6 inches (15.2 centimetres) wide and are fully cemented, with the upper sheet overlapping the lower sheet so that water will flow over, rather than against, the joint.

The remaining steps in applying double-coverage roll roofing parallel to the rake, including the hip and ridge treatment, are essentially the same as in horizontal application.

**Study Assignment**

Obtain and study industry publications that describe roll-roofing products and their methods of application. (See the Instructional Materials section on page 50 of this workbook.)

## ASPHALT AND WOOD SHINGLING

## TOPIC 7—APPLICATION OF WOOD SHINGLES AND SHAKES

This topic and the related instruction classes are designed to enable the apprentice to do the following:

- **Distinguish between wood shingles and wood shakes by describing their grades, sizes, packaging, and uses as roofing materials.**
- **Describe the deck requirements for a wood-shingle or wood-shake roof.**
- **Discuss how the weather exposure of a wood-shingle or wood-shake roof is related to roof slope and shingle or shake size.**
- **Identify the types and sizes of fasteners used to apply wood shingles and wood shakes.**
- **Describe the flashing materials and methods used in wood-shingle and wood-shake roofing.**
- **Describe some methods of providing the ventilation needed to prevent condensation of moisture on the underside of a wood-shingle or wood-shake roof.**
- **Describe typical installation procedures for wood shingles and wood shakes.**

### General Requirements for Wood-Shingle and Wood-Shake Roofs

Wood shingles are sawed products. Both sides of a wood shingle are relatively smooth, and the butt is of uniform thickness over its full width. Wood shakes are split rather than sawed from the log, and their butt thickness varies. Both sides of taper-split and straight-split shakes have uneven, highly textured surfaces; hand-split-and-resawn shakes are smooth on one side. (See "Wood Shingles and Shakes" in Topic 1.)

Wood shingles and wood shakes are applied in basically the same way; the differences are mainly in the width and spacing of the sheathing boards when open sheathing is used, recommended exposures to the weather, spacing between adjacent units, recommended nail lengths, and application of roofing felt. The general requirements that follow apply to both types of roofing; specific application procedures for wood shingles and wood shakes are given later in this topic.

#### Roof Decks

Wood shingles and wood shakes are suitable for use on nailable roofs that have sufficient slope to ensure adequate drainage. In general, this means a slope of 4/12 or greater, but satisfactory installations have been made on slopes as low as 3/12 by reducing the exposure of the shingles or shakes and using special application methods. (Low-slope installations must conform to special requirements in local building codes.)

Wood shingles and shakes may be applied over either open or solid sheathing, except that only solid sheathing should be used where wind-driven snows are encountered. If a deck with open sheathing is to be covered with wood shingles, the sheathing boards should be 1 x 4 inch (2.5 x 10.2 centimetre) lumber, and the space between the boards should be not more than 4 inches (10.2 centimetres). The distance between centers of the boards (and, therefore, the space between the boards) is governed by the weather exposure of the shingles; for example, if the shingles are to have a 5-inch (12.7-centimetre) exposure to the weather, the boards should be spaced so the distance between their centers is also 5 inches (12.7 centimetres). When wood shakes instead of wood shingles are installed over open sheathing, the sheathing boards should be 1 x 6s (2.5 x 15.2 centimetres) spaced so the distance between their centers is equal to the exposure of the shakes.

The roof deck should be inspected to make sure it is in satisfactory condition to receive the wood shingles or shakes. The inspection should include the supporting framing members as well as the sheathing. (See "Inspection of the Roof Structure" in Topic 3.)

#### Exposure

The weather exposure of installed shingles and shakes is the distance from butt line to butt line in the successive courses. The proper amount of exposure to use depends mainly on the slope of the roof and the type and size of the shingles or shakes. On roof slopes of 4/12 or greater, the standard exposures for No. 1 grade cedar shingles are as follows: for 16-inch (40.6-centimetre) shingles, 5 inches (12.7 centimetres); for 18-inch (45.7-centimetre) shingles, 5½ inches (14 centimetres); and for 24-inch (61-centimetre) shingles, 7½ inches (19.1 centimetres). On roof slopes less than 4/12 and down to 3/12, the exposures for the three shingle lengths should be reduced to 3¾, 4¼, and 5¾ inches (9.5, 10.8, and 14.6 centimetres), respectively. Reduced exposures are also recommended for No. 2 and No. 3 grade shingles on all roof slopes.

The standard exposures for wood shakes on roofs with slopes of 4/12 or greater are 7½ inches (19.1 centimetres) for 18-inch (45.7-centimetre) shakes and 10 inches (25.4 centimetres) for 24-inch (61-centimetre) shakes. (See tables 7-1 and 7-2.)

**Fasteners**

Shingles and shakes are fastened to the deck with corrosion-resistant nails or staples. The fasteners most often used are galvanized or aluminum nails. The nails must be long enough to penetrate ¾ inch (1.9 centimetres) into the sheathing. They may be allowed to project through the sheathing except at eave and rake overhangs, porch roofs, and other locations where they would be visible on the underside of the sheathing. The fasteners commonly used to attach 16-inch (40.6-centimetre) and 18-inch (45.7-centimetre) shingles in new construction are 3-penny (3d ) nails; 24-inch (61-centimetre) shingles require 4d nails. Wood shakes are normally fastened with 6d nails, but 7d or longer nails may be required if the shakes are unusually thick or are applied with reduced exposure. Shake hip and ridge units are applied with 8d nails. (See Fig. 7-1.) When wood shingles or shakes are applied over existing roofing materials, the required nail length will be determined by the thickness of the old roofing.

**Flashing Details**

Wood shingles and wood shakes are flashed with corrosion-resistant metal of No. 26 gage or heavier. Some manufacturers of wood shingles and shakes recommend that galvanized-metal flashing be painted with a heavy-bodied lead-and-oil paint or bituminous paint before it is installed.

Valley-flashing metal should have a center crimp, which serves as a water diverter. The valley metal should be applied over a 36-inch-wide (91.4-centimetre-wide) strip of No. 15 or heavier felt underlayment, as shown in Figure 7-2. The metal must extend at least 8 inches (20.3 centimetres) each way from the valley centerline for wood shingles and 11 inches (27.9 centimetres) each way from the centerline for wood shakes. Sections of flashing must have an overlap of not less than 4 inches (10.2 centimetres).

Other flashing details for wood-shingle and wood-shake roofs are shown in figures 7-3 through 7-7.

TABLE 7-1

**Exposure Requirements for Wood Shingles**

| SLOPE | Maximum exposure recommended for roofs: | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | NO. 1 | | | NO. 2 | | | NO. 3 | | |
| | 16" | 18" | 24" | 16" | 18" | 24" | 16" | 18" | 24" |
| 3 IN 12 TO 4 IN 12 | 3¾" | 4¼" | 5¾" | 3½" | 4" | 5½" | 3" | 3½" | 5" |
| 4 IN 12 AND STEEPER | 5" | 5½" | 7½" | 4" | 4½" | 6½" | 3½" | 4" | 5½" |

| LENGTH AND THICKNESS | Approximate coverage of one square (4 bundles) of shingles based on following weather exposures | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3½" | 4" | 4½" | 5" | 5½" | 6" | 6½" | 7" | 7½" | 8" | 8½" | 9" | 9½" |
| 16 × 5½ | 70 | 80 | 90 | 100• | 110 | 120 | 130 | 140 | 150‡ | 160 | 170 | 180 | 190 |
| 18 × 5/2½ | .... | 72½ | 81½ | 90½ | 100• | 109 | 118 | 127 | 136 | 145½ | 154½‡ | 163½ | 172½ |
| 24 × 4/2 | .... | .... | .... | .... | .... | 80 | 86½ | 93 | 100• | 106½ | 113 | 120 | 126½ |
| | 10" | 10½" | 11" | 11½" | 12" | 12½" | 13" | 13½" | 14" | 14½" | 15" | 15½" | 16" |
| 16 × 5½ | 200 | 210 | 220 | 230 | 240† | .... | .... | .... | .... | .... | .... | .... | .... |
| 18 × 5/2½ | 181½ | 191 | 200 | 209 | 218 | 227 | 236 | 245½ | 254½† | .... | .... | .... | .... |
| 24 × 4/2 | 133 | 140 | 146½ | 153‡ | 160 | 166½ | 173 | 180 | 186½ | 193 | 200 | 206½ | 213† |

NOTES: •Maximum exposure recommended for roofs.
†Maximum exposure recommended for double-coursing No. 1 grades on sidewalls.
‡Maximum exposure recommended for single-coursing No. 1 and No. 2 grades on sidewalls.

*All weights and dimensions are APPROXIMATE.

TABLE 7-2

**Exposure Requirements for Wood Shakes**

| SHAKE TYPE, LENGTH AND THICKNESS | Approximate coverage (in sq. ft.) of one square, when shakes are applied with ½" spacing, at following weather exposures, in inches (h): | | | | | |
|---|---|---|---|---|---|---|
| | 5½" | 7½ | 8½ | 10 | 11½ | 16 |
| 18" × ½" Handsplit-and-Resawn Mediums (a) | 55(b) | 75(c) | 85(d) | 100 | .... | .... |
| 18" × ¾" Handsplit-and-Resawn Heavies (a) | 55(b) | 75(c) | 85(d) | 100 | .... | .... |
| 24" × ⅜" Handsplit | .... | 75(e) | 85 | 100(f) | 115(d) | .... |
| 24" × ½" Handsplit-and-Resawn Mediums | .... | 75(b) | 85 | 100(c) | 115(d) | .... |
| 24" × ¾" Handsplit-and-Resawn Heavies | .... | 75(b) | 85 | 100(c) | 115(d) | .... |
| 24" × ½" Tapersplit | .... | 75(b) | 85 | 100(c) | 115(d) | .... |
| 18" × ⅜" True-Edge Straight-Split | .... | .... | .... | .... | .... | 112(g) |
| 18" × ⅜" Straight-Split | 65(b) | 90 | 100(d) | .... | .... | .... |
| 24" × ⅜" Straight-Split | .... | 75(b) | 85 | 100 | 115(d) | .... |
| 15" Starter-Finish Course | Use supplementary with shakes applied not over 10" weather exposure | | | | | |

(a) 5 bundles will cover 100 sq. ft. roof area when used as starter-finish course at 10" weather exposure; 6 bundles will cover 100 sq. ft. wall area at 8½" exposure; 7 bundles will cover 100 sq. ft. roof area at 7½" weather exposure; see footnote (h).

(b) Maximum recommended weather exposure for 3-ply roof construction.

(c) Maximum recommended weather exposure for 2-ply roof construction.

(d) Maximum recommended weather exposure for single-coursed wall construction.

(e) Maximum recommended weather exposure for application on roof pitches between 4-in.-12 and 8-in.-12.

(f) Maximum recommended weather exposure for application on roof pitches of 8-in.-12 and steeper.

(g) Maximum recommended weather exposure for double-coursed wall construction.

(h) All coverage based on ½" spacing between shakes.

For detailed information on all cedar products, write to: Red Cedar Shingle & Handsplit Shake Bureau, 5510 White Building, Seattle, Washington 98101.
(In Canada: Suite 1500, 1055 West Hastings Street, Vancouver, B.C. V6E 2HI)

*All weights and dimensions are APPROXIMATE.

### Ventilation

Wood-shingle and wood-shake roofs must have adequate ventilation to keep moisture from condensing on the underside of the sheathing and if open sheathing is used, on the underside of the shingles or shakes. The general rule for ventilating attics and enclosed rafter spaces is that 1 square foot (0.09 square metre) of unobstructed vent area should be provided for each 150 square feet (13.9 square metres) of the area under the space to be ventilated. (Local codes may contain other ventilation requirements.) Some typical construction details for providing the required ventilation are shown in figures 7-8, 7-9, and 7-10.

## Application of Wood Shingles

Wood shingles are usually applied in straight, uniformly spaced courses, as shown in Figure 7-11. The shingles in the field area of the roof should be from 4 to 8 inches (10.2 to 20.3 centimetres) wide. Wider shingles should be split and nailed as two shingles. Some wide shingles should be saved for use at the valleys and hips, where the shingles must be mitered.

### Positioning and Driving Nails

Each shingle should be fastened with only two nails. The nails should be set in ¾ inch (1.9 centimetres) from each side of the shingle and 1 inch (2.5 centimetres) above the butt line of the course that is to follow. They should be driven flush to the surface of the shingle but not so hard as to crush the fibers of the wood. (See Fig. 7-12.) Correct nailing is important; if the nails are placed too high or too far in from the sides, the shingle will curl.

### Applying the Starter Course and the First Course

The shingles are doubled at the eaves by laying the first course over a starter course, as shown in Figure

7-11. Neighboring shingles should be spaced approximately ⅜ inch (1 centimetre) apart, and the spaced joints should be offset at least 1½ inches (3.8 centimetres) from the joints underneath. (Local codes may require different spacing.) The butts of the combined starter course and first course should extend 1 inch (2.5 centimetres) beyond the edge of the eaves to ensure proper runoff into the gutter; if there is no gutter, the butt overhang should be increased to 1½ inches (3.8 centimetres). The shingles at the gable ends of the roof should overhang the rakes by 1 inch (2.5 centimetres).

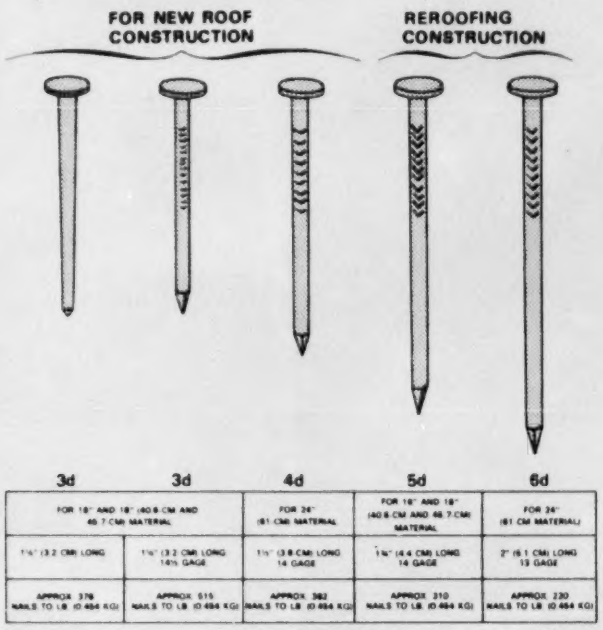



Fig. 7-1. Nails for wood shingles and shakes

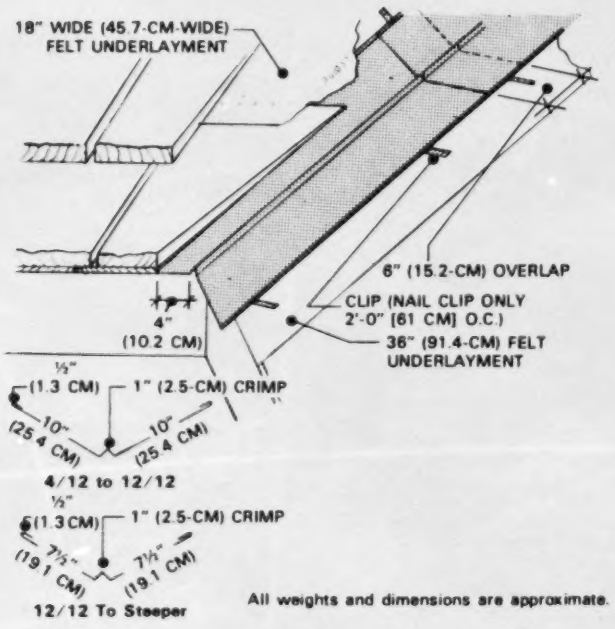



Fig. 7-2. Valley flashing

### Applying the Remaining Courses

Wood shingles are usually applied four or five courses at a time, starting from the left side of the roof if the roofer is right-handed; this enables the roofer to cover the deck in the least number of moves. Chalk lines can be helpful in maintaining shingle alignment on a deck with solid sheathing, but an experienced roofer may prefer to position and align the shingles with just the shingle gage on a roofing hatchet and a tape rule. (See "Shingling Tools and Equipment" in Topic 1.) The shingles should be spaced ¼ to ⅜ inch (0.6 to 1 centimetre) apart, and the joints should be staggered at least 1½ inches (3.8 centimetres), as in the

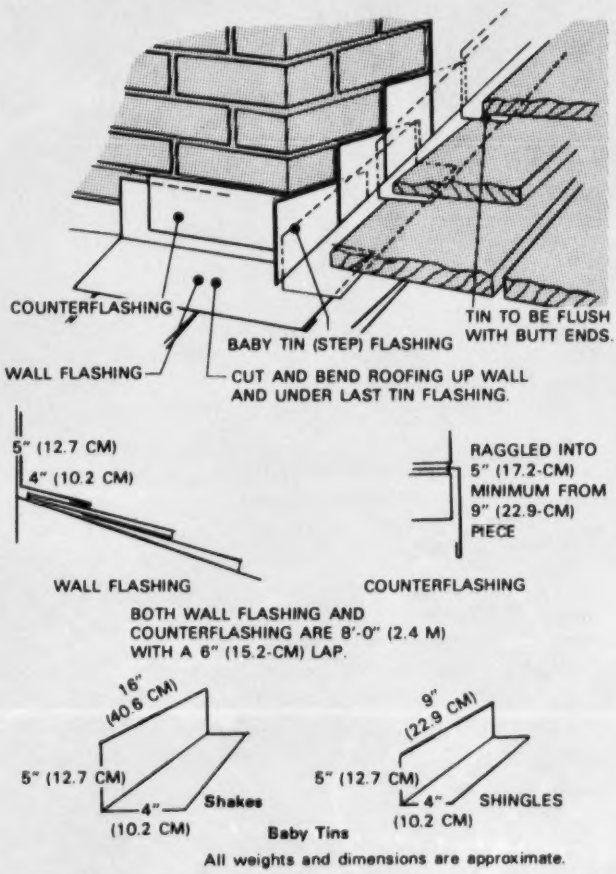

COUNTERFLASHING
TIN TO BE FLUSH WITH BUTT ENDS.
BABY TIN (STEP) FLASHING
WALL FLASHING
CUT AND BEND ROOFING UP WALL AND UNDER LAST TIN FLASHING.
5" (12.7 CM)
4" (10.2 CM)
RAGGLED INTO 5" (17.2-CM) MINIMUM FROM 9" (22.9-CM) PIECE
WALL FLASHING
COUNTERFLASHING
BOTH WALL FLASHING AND COUNTERFLASHING ARE 8'-0" (2.4 M) WITH A 6" (15.2-CM) LAP.
16" (40.6 CM)
5" (12.7 CM)
4" (10.2 CM)
Shakes
9" (22.9 CM)
5" (12.7 CM)
4" (10.2 CM)
SHINGLES
Baby Tins
All weights and dimensions are approximate.

Fig. 7-3. Application of flashing at walls and other vertical intersections

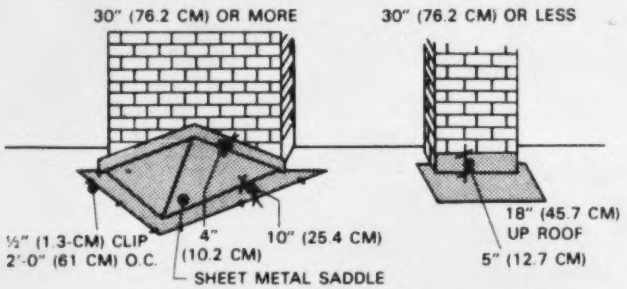
first and starter courses. No joints in any three adjacent courses should be in direct alignment.

Where the shingles meet a valley or a hip, they should be mitered as shown in Figure 7-13. Only two nails should be used to fasten a valley shingle, and they should be kept away from the center of the valley. The mitered edge of the shingle should be spaced 2½ to 3 inches (6.4 to 7.6 centimetres) away from the center crimp in the valley metal.

### Covering Hips and Ridges

Hips and ridges should be covered with shingles of uniform width, assembled with alternating overlaps as shown in Figure 7-14. The hip and ridge covers may be made on the job, but many roofers prefer to use prefabricated cover units, which save installation time and provide a more uniform appearance. The hip and ridge cover units should have the same exposure as the shingles in the field area of the roof, and they should be applied with concealed nails. Only two nails need be used, one on each side of the cover unit, but they must be long enough to penetrate the underlying sheathing ¾ inch (1.9 centimetres). The starting cover unit on a hip or ridge should be double coursed.

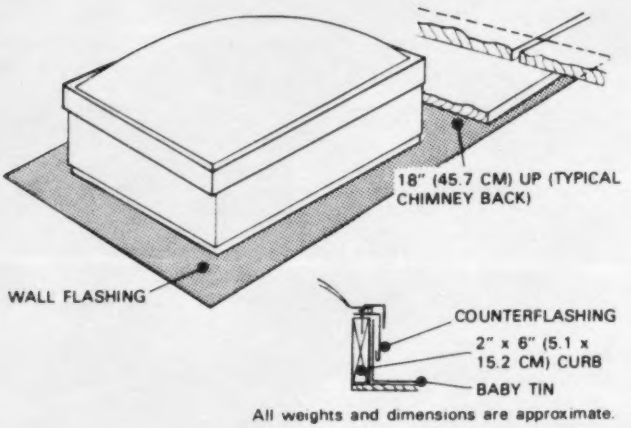
For balanced appearance the last course of shingles at the ridge should have the same exposure as all the preceding courses. This will present no problem if the distance from the butts of the first course to the edge of the ridge cap is an exact multiple of the specified exposure. Otherwise, the exposure of the shingles should be reduced slightly, beginning about midway between the eaves and the ridge, to obtain the proper exposure at the last course.




*NOTE:* IF LARGE ENOUGH, A SADDLE IS OPTIONAL. ALL JOINTS MUST BE SOLDERED.

All weights and dimensions are approximate.

**Fig. 7-4. Flashing at the rear of a chimney**

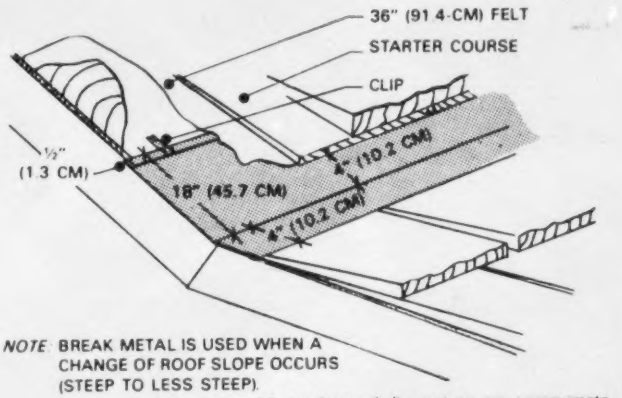



All weights and dimensions are approximate.

**Fig. 7-5. Flashing at a skylight**

### Application of Wood Shakes

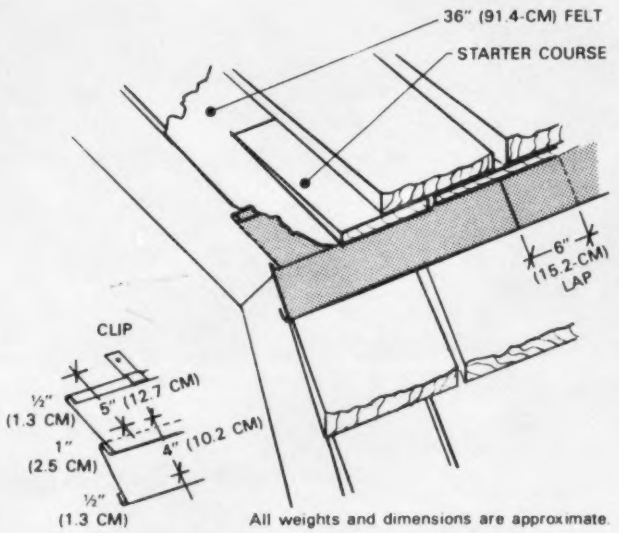
Wood shakes are applied in basically the same way as wood shingles. The roof deck may be either spaced




*NOTE:* BREAK METAL IS USED WHEN A CHANGE OF ROOF SLOPE OCCURS (STEEP TO LESS STEEP).

All weights and dimensions are approximate.

**Fig. 7-6. Break-metal flashing**




All weights and dimensions are approximate.

**Fig. 7-7. Flashing at a gambrel**

or solid, depending on the prevailing climate. Spaced sheathing is practical in snow-free areas; solid sheathing covered with No. 30 felt underlayment is required in areas where wind-driven snows are encountered. (Local codes may vary.)

The slope of the roof should be sufficient (4/12 or more) to ensure good drainage. The maximum recommended weather exposures for wood shakes are 7½ inches (19.1 centimetres) for 18-inch (45.7-centimetre) shakes and 10 inches (25.4 centimetres) for 24-inch (61-centimetre) shakes. Applying the shakes with maximum exposure results in a two-ply roof; a three-ply roof can be obtained at moderate extra cost by reducing the exposures to 5½ inches (14 centimetres) for 18-inch (45.7-centimetre) shakes and 7½ inches (19.1 centimetres) for 24-inch (61-centimetre) shakes. (See Fig. 7-15.)

**Placing and Driving Nails**

Each shake is fastened with only two nails, which are driven 1 inch (2.5 centimetres) from each side of the shake and 1 or 2 inches (2.5 or 5.1 centimetres) above the butt line of the course that is to follow. The nails should be driven flush to the surface of the shake but not so hard as to crush the wood fibers.

**Applying the Starter Course and the First Course**

The first course of a shake roof must be doubled at the eaves, using either 15-inch (38.1-centimetre) or 18-inch (45.7-centimetre) shakes for the starter course. (Wood shingles may also be used for the starter

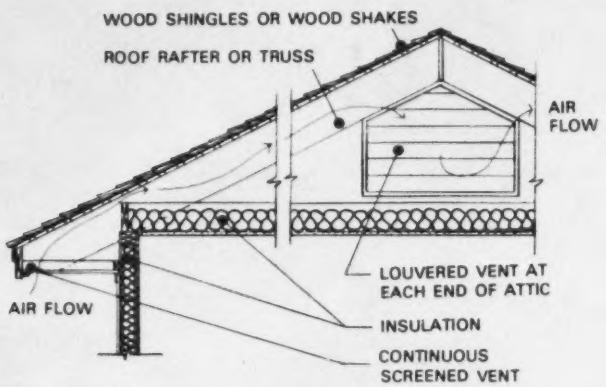



**Fig. 7-8. Ventilation for a gable roof with an attic**

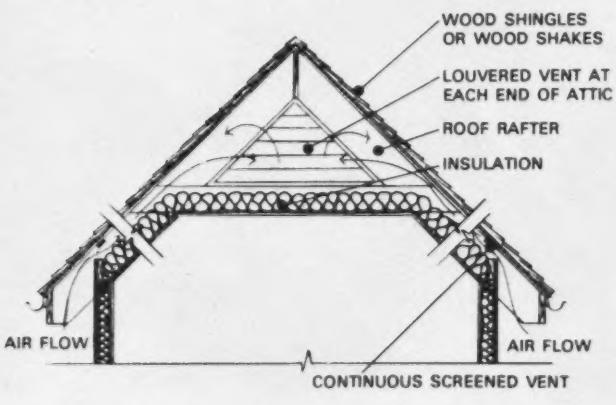



**Fig. 7-9. Ventilation for a cathedral ceiling with a partial attic**

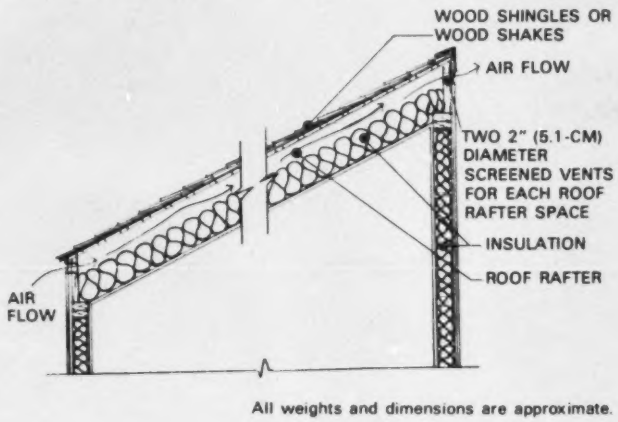

WOOD SHINGLES OR WOOD SHAKES
AIR FLOW
TWO 2" (5.1-CM) DIAMETER SCREENED VENTS FOR EACH ROOF RAFTER SPACE
INSULATION
ROOF RAFTER
AIR FLOW
All weights and dimensions are approximate.

**Fig. 7-10. Ventilation for a shed roof**

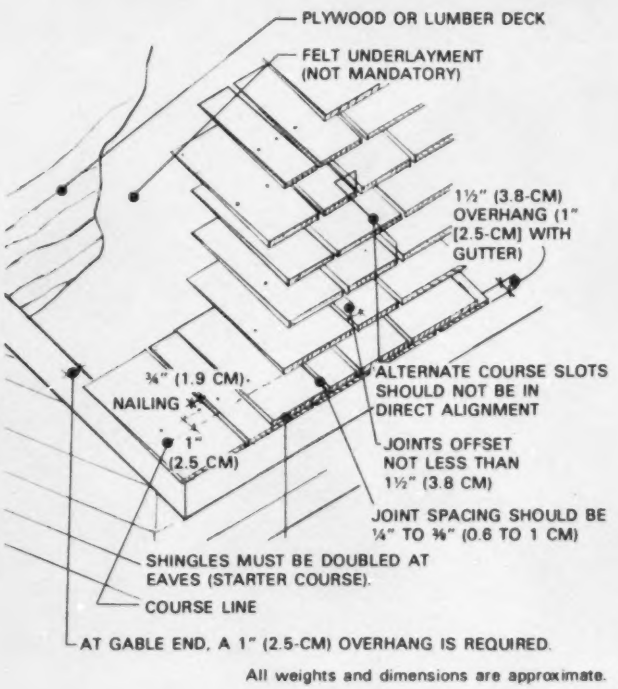

PLYWOOD OR LUMBER DECK
FELT UNDERLAYMENT (NOT MANDATORY)
1½" (3.8-CM) OVERHANG (1" [2.5-CM] WITH GUTTER)
¾" (1.9 CM) NAILING
1" (2.5 CM)
ALTERNATE COURSE SLOTS SHOULD NOT BE IN DIRECT ALIGNMENT
JOINTS OFFSET NOT LESS THAN 1½" (3.8 CM)
JOINT SPACING SHOULD BE ¼" TO ⅜" (0.6 TO 1 CM)
SHINGLES MUST BE DOUBLED AT EAVES (STARTER COURSE).
COURSE LINE
AT GABLE END, A 1" (2.5-CM) OVERHANG IS REQUIRED.
All weights and dimensions are approximate.

**Fig. 7-11. Application of wood shingles**

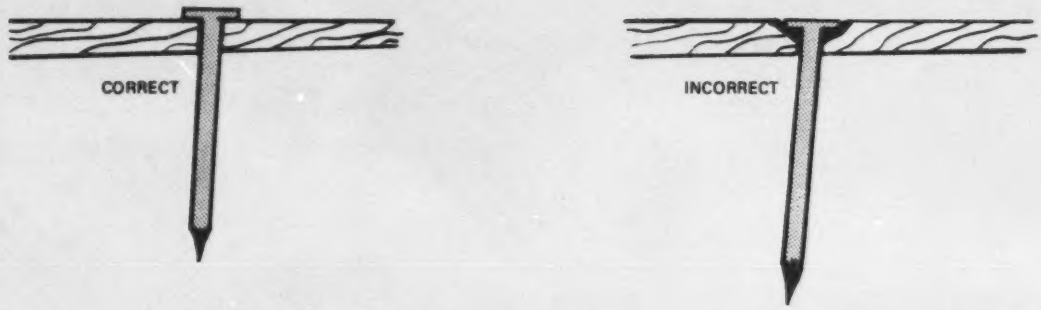



Fig. 7-12. Correct and incorrect nailing

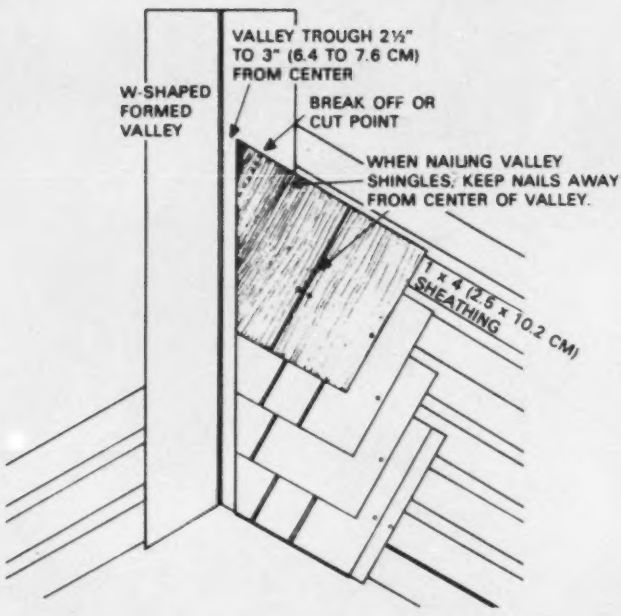

VALLEY TROUGH 2½" TO 3" (6.4 TO 7.6 CM) FROM CENTER
W-SHAPED FORMED VALLEY
BREAK OFF OR CUT POINT
WHEN NAILING VALLEY SHINGLES, KEEP NAILS AWAY FROM CENTER OF VALLEY.
1 x 4 (2.5 x 10.2 CM) SHEATHING

Fig. 7-13. Shingling to a valley

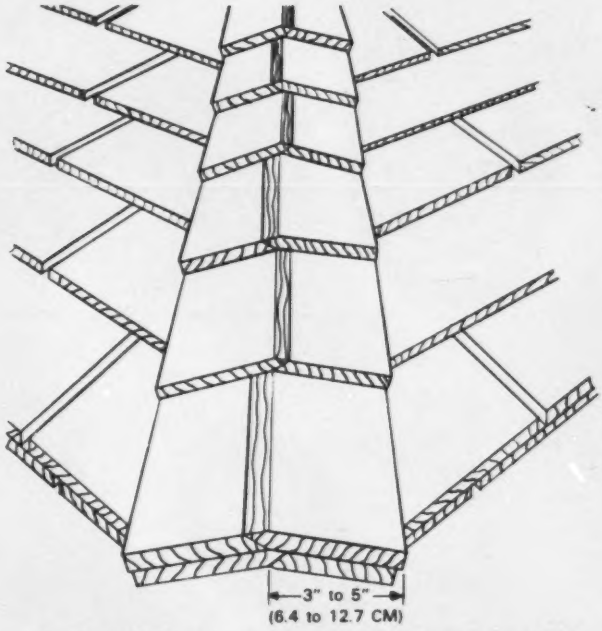



Fig. 7-14. Hip and ridge caps (wood shingle roof)

course.) The butts of the combined first course and starter course should overhang the edge of the eaves at least 1½ inches (3.8 centimetres) if the roof has no gutter and ¾ inch (1.9 centimetres) if it has a gutter. The shakes should extend beyond the rake edges approximatley 1 inch (2.5 centimetres).

Before wood shakes are installed over spaced sheathing, overlapping sheets of No. 30 roofing felt 18 inches (45.7 centimetres) wide are nailed to the sheathing boards; then the shakes are slipped between the felts and nailed in place. (See Fig. 7-16.) The first felt under the starter course is shown as a full-width sheet in the illustration, but the use of 18-inch-wide (45.7-centimetre-wide) felt here is also acceptable. (Local codes may vary.) The bottom edge of the first felt should slightly overhang the first sheathing board.

**Applying the Remaining Courses**

Wood shakes are usually applied four or five courses at a time, using basically the same procedure as for wood shingles. The felts between the courses are placed so they overlap the tops of the shakes 4 inches (10.2 centimetres) and extend 14 inches (35.6 centimetres) onto the sheathing. The felts are fastened to the sheathing at the top edge with a row of nails spaced about 12 inches (30.5 centimetres) on centers. As the courses approach the ridge, the shakes and the interlaced felts are trimmed off at the top so that they will not extend beyond the center of the ridge. (See Fig. 7-16.)

The shakes within a course should be spaced approximately ½ inch (1.3 centimetres) apart. The joints between the shakes should be offset at least 1½

inches (3.8 centimetres) in adjacent courses, as in application of wood shingles.

**Covering Hips and Ridges**

The hips and ridges of a shake roof are covered in basically the same way as those of a wood-shingle roof. (See Fig. 7-17.) The cover units may be assembled on the job, using selected shakes with a uniform width of 4 to 6 inches (10.2 to 15.2 centimetres), or they may be prefabricated units. The cover units should be installed with alternating overlaps and with the same exposure as the shakes in the field area of the roof. They should be fastened with two nails in the same manner as the shakes, using nails long enough to penetrate ¾ inch (1.9 centimetres) into the sheathing. Some shake roofing specifications call for a narrow strip of No. 15 or heavier roofing felt to be placed over the crown of the hip or ridge before the cover units are installed.

A continuous ridge that terminates in a gable at each end requires special treatment. The cover units must be applied from each end of the ridge, starting with a double course at each gable. Where the two lines of cover units meet at the midpoint of the ridge, the joint should be covered with a small saddle made of shake butts.

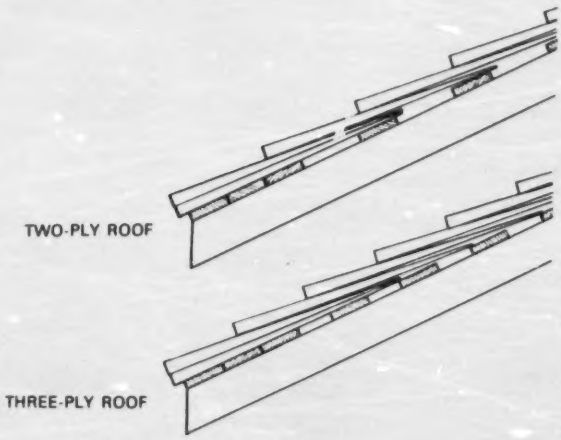



**Fig. 7-15. Two-ply and three-ply shake roofs**

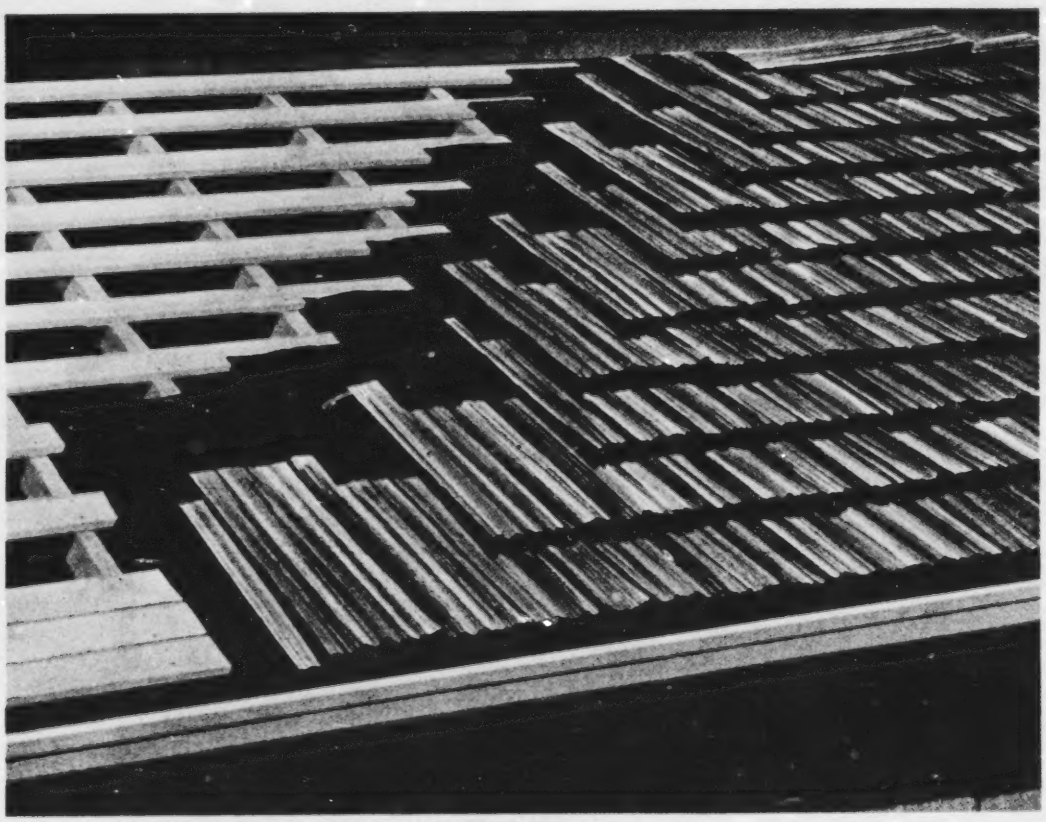


**Fig. 7-16. Application of wood shakes**

### Reroofing with Wood Shingles and Shakes

In general, wood shingles and wood shakes may be applied directly over common types of existing roofing materials; some exceptions are tile, slate, asbestos shingles, and wood shakes. Before application of the shingles or shakes is begun, the existing roof should be inspected and prepared for recovering as described in topics 3 and 5. Existing asphalt shingles or wood shingles should be trimmed back to the edge of the deck at the gables, and metal edging should then be installed over the trimmed shingles. The old hip and ridge coverings should be removed. Normally, new valleys and other flashings and counterflashings will have to be installed. Wood strips should be nailed in the existing valleys to separate the new metal from the old.

When wood shingles are applied over wood shingles, any curled shingles must be split and nailed down, and any missing shingles must be replaced; voids or high spots on the old roof will show through on the new roof. To ensure a smooth base, the roofer may have to apply strip sheathing over the existing wood shingles. Nails used to fasten the new shingles or shakes must be long enough to penetrate the underlying sheathing ¾ inch (1.9 centimetres). Wood shakes must be applied with felt strips interwoven between the courses, as in new construction. In all respects the finished appearance of the recovered roof should be equal to that of a new roof.

### Study Assignment

Obtain and study sales brochures, sample roofing specifications, and application instructions for wood-shingle and wood-shake roofs published by manufacturers and trade associations in this part of the roofing industry. (See the Instructional Materials section on page 50 of this workbook.

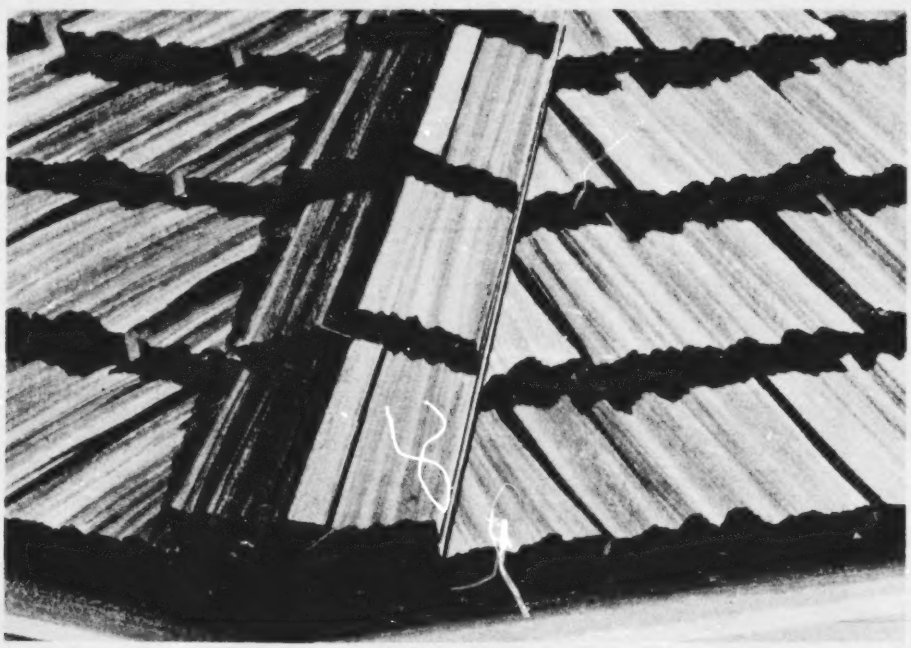


Fig. 7-17. Hip and ridge caps

# Instructional Materials

### Required Materials

*Common Roofing and Waterproofing Materials and Equipment.* Sacramento: California State Department of Education, 1982. (Orders to: California State Department of Education, Publications Sales, P.O. Box 271, Sacramento, CA 95802.)

*Construction Safety Orders* (Current edition). San Francisco: California State Department of Industrial Relations, Division of Industrial Safety. (Orders to: Department of General Services, Publications Section, P.O. Box 20191, Sacramento, CA 95820.)

*Entering the Roofing and Waterproofing Industry.* Sacramento: California State Department of Education, 1980. (Orders to: California State Department of Education, Publications Sales, P.O. Box 271, Sacramento, CA 95802.)

*Uniform Building Code* (Current edition). Whittier, Calif.: International Conference of Building Officials. (Orders to: International Conference of Building Officials, 5360 S. Workman Mill Road, Whittier, CA 90601.)

### Materials Suggested for the Classroom

Clark, Donald H. *Certi-Split Manual of Handsplit Red Cedar Shakes.* Bellevue, Wash.: Red Cedar Shingle and Handsplit Shake Bureau, 1971. (Orders to: Red Cedar Shingle and Handsplit Shake Bureau, 515 116th Avenue., N.E., Bellevue, WA 98004.)

Johnson, William E. *Roofers Handbook.* Solana Beach, Calif.: Craftsman Book Company, 1976. (Orders to: Craftsman Book Company, 542 Stevens Avenue, Solana Beach, CA 92075.)

*The NRCA Steep Roofing Manual.* Oak Park, Ill.: The National Roofing Contractors Association, 1981. (Orders to: The National Roofing Contractors Association, 1515 North Harlem Avenue, Oak Park, IL 60302.)

*Red Cedar Shingles and Shakes.* Brochure No. 979. Bellevue, Wash.: Red Cedar Shingle and Handsplit Shake Bureau, n.d. (Orders to: Red Cedar Shingle and Handsplit Shake Bureau, 515 116th Avenue, N.E., Bellevue, WA 98004.)

*Residential Asphalt Roofing Manual.* Washington: Asphalt Roofing Manufacturers Association, 1980. (Orders to: Asphalt Roofing Manufacturers Association, 1800 Massachusetts Avenue, N.W., Suite 702, Washington, DC 20036.)

# Glossary

The definitions of terms included in this glossary are those pertinent to the roofing trade and are not necessarily those found in standard dictionaries. Some of the terms included are colloquial in nature and are used with the meanings applicable only to the roofing trade.

*A-frame.* A portable frame built in the shape of the letter A and used by roofers to hoist materials.

*Apex.* The point, tip, or summit of anything; the highest point of any roof or structure.

*Asbestos.* A fibrous, noncombustible mineral used to make fire-retardant roofing.

*Asphalt.* A brownish-black, natural petroleum residue used in the manufacture of roofing materials.

*Asphalt felt.* An asphalt-saturated or asphalt-coated felt. (See *Felt.*)

*Asphalt plastic cement.* A thick, adhesive mixture of asphaltic material and mineral fillers or other additives; used as a sealant or cement in various roofing applications. Available in many formulations and weights. Trowel-grade products of this type are also called mastics or flashing cements.

*Asphalt shingle.* A shingle made from an organic felt or inorganic fiberglass base mat treated with asphalt saturants and coatings and covered on one side with mineral granules. Also called a composition shingle.

*Base sheet.* The first layer of roofing applied on the deck. Also, a dry sheet or slip sheet. (See *Underlayment* and *Slip sheet.*)

*Bevel.* To give a sloping edge; to slant or incline. (*T-bevel:* a tool used to test the accuracy of beveled edges.)

*Bond.* The adhesive and cohesive forces that hold two roofing components in intimate contact. (*Manufacturer's bond:* A written warranty provided by a roofing-material manufacturer that protects the buyer if the product should prove defective during the warranty period.)

*Building code.* Governmental rules and regulations pertaining to the construction, repair, and demolition of buildings and related structures.

*Butt.* The lower end of a shingle. Also, a short length of material, such as the remnant of roofing material left over when a roll has been cut into usable lengths.

*Butt joint.* The joint formed by two pieces of roofing material fitted squarely against each other without overlapping.

*Canopy.* An overhanging roof-like structure.

*Cap flashing.* See *Counterflashing.*

*Caulk.* To make watertight by plugging with mastic.

*Chalk line.* A heavy string or cord used to establish a line.

*Chicken ladder.* A lightweight ladder equipped with a cleat so that it can be hung over the ridge for work on a steep roof.

*Composition shingle.* See *Asphalt shingle.*

*Condensation.* The conversion of water vapor to water as the temperature drops or the atmospheric pressure rises. Heavy condensation on the underside of a roof may give the appearance of a leak.

*Counterflashing.* Flashing that extends over another flashing. Also called cap flashing.

*Course.* A continuous row or layer of shingles or other roofing material.

*Coverage.* The area covered by a given quantity of roofing material, with an allowance made for lapping.

*Cricket.* A superimposed structure installed in a roof area, for example behind a chimney, to divert water and assist drainage. Also called a saddle.

*Cutout.* The narrow slot between the tabs of an asphalt strip shingle.

*Deck.* The roof surface to be covered. Also, a small platform used as a walkway.

*Delamination.* Separation of the plies in plywood sheathing or in the built-up membrane of a multiply roofing system. Also, separation of the layers in a laminated insulation material.

*Diverter.* A piece of metal bent at right angles to change the flow of rainwater.

*Dormer.* A small, gable-roofed structure built on a sloping roof to provide a window for a finished attic.

*Double course.* A course of roofing material consisting of two layers, one directly above the other, as in the double course of shingles applied along the eaves.

*Double-coverage roofing.* Shingles or roll roofing applied with sufficient overlap so that no part of the deck is covered with less than two layers of

roofing. Double-coverage roll-roofing material is called split sheet or 19-inch (48.3-centimetre) selvage.

*Downspout.* A pipe used to carry water from the roof to the ground.

*Dry rot.* Wood decay caused by a fungus that consumes the cellulose portion of the wood, leaving a soft skeleton that readily crumbles to a powder. Wood structures that are inadequately ventilated and constantly exposed to moisture are especially vulnerable to dry rot.

*Dry sheet.* See *Slip sheet.*

*Eave.* The projecting lower edge of a roof.

*Eaves trough.* See *Gutter.*

*Exposure.* The portion of a course of shingles or roll roofing that is exposed to the weather.

*Felt.* A general term for various roll-roofing materials used as base sheets, interplies, reinforcement fabric, or flashing. Felts are manufactured from vegetable fibers (organic felts), asbestos fibers (asbestos felts) or glass fibers (glass-fiber felts), and they are available in dry (unsaturated) form or treated with asphalt or coal-tar saturants and coatings.

*Flashing.* Sheets of metal or other suitable material used to make watertight joints in roofs.

*Flashing cement.* See *Asphalt plastic cement.*

*Flush.* Surfaces are said to be flush when they meet on the same plane and form a single, unbroken surface.

*Gable.* The vertical triangle formed by the end of a gable roof.

*Gable roof.* A ridged, double-sloping roof.

*Galvanized metal.* Iron or steel that has been coated with zinc for protection against rust and corrosion.

*Gutter.* A trough installed along the eaves to carry off water.

*Hanger.* A metal strap used to secure a gutter to the eaves.

*Hip cap or ridge cap.* The weatherproofing cover installed over the apex of a hip or ridge. The hip or ridge cap is normally made of the same roofing material used in the field area of the roof.

*Hip roof.* A roof that has sloping ends and thus four sloping sides. The line where adjacent sloping sides meet is called a hip.

*Insulation.* A material used to block the passage of heat or sound; also used to reduce fire hazard.

*Joint.* The point at which two or more surfaces are joined.

*Ladder jack.* A metal bracket installed on a ladder to support a scaffold plank; used in pairs on two ladders.

*Lean-to roof.* See *Shed roof.*

*Metal edging.* A metal trim used around the outside edges of a roof; also called nosing.

*Metric shingle.* An asphalt shingle made to metric dimensions.

*Nineteen-inch (48.3-centimetre) selvage.* See *Double-coverage roofing.*

*Nosing.* See *Metal edging.*

*Offset.* A recess in the plane of a wall, or a broken line in the eave or gable of a roof. Also, the horizontal distance between the cutouts or the shingle edges in adjacent courses of a composition- or wood-shingle roof.

*Overhang.* The portion of a roof that extends beyond the exterior wall line.

*Pipe jack.* A preformed metal or plastic flashing unit that slips over and weatherproofs a vent pipe. Also called a pipe collar or a vent sleeve.

*Pitch.* The pitch of a roof is expressed as a fraction obtained by dividing the rise by the span. For example, the pitch of a roof with a 6-foot (1.8-metre) rise and a 24-foot (7.3-metre) span is 6/24, or 1/4 (a quarter-pitch roof). The slope of a roof may also be indicated by the relation of the rise to the run. (See *Slope;* see also *Rise, Run,* and *Span.*)

*Plans.* Drawings showing the proportions and relations of parts of a building.

*Ply.* A layer of roofing material.

*Rafter.* A sloping timber that gives support to a roof.

*Rake.* The sloping edge on a gable roof.

*Recover (reroof).* To apply a new roof over an old roof.

*Ridge.* The point on a double-sloping roof where therafters meet the ridgepole.

*Ridgepole.* The highest horizontal timber in a roof.

*Ridge cap.* See *Hip cap.*

*Rise.* The vertical height of the top of a roof above the plate line; also, the increase in height of a rafter per foot of run.

*Roofing.* Roofs collectively; materials for roofs; the act of covering a roof.

*Roof jack.* A metal bracket temporarily nailed to a sloped roof to support a scaffold plank; used in pairs.

*Run.* One-half the distance of the span of a roof. Also, a row of shingles running from the eave to the ridge.

*Saddle.* See *Cricket.*

*Scaffold.* A temporary elevated structure for the support of workers and materials during the construction or repair of a building.

*Sealant.* A sealing agent (flashing cement, for example).

*Selvage.* An edge that differs from the main part of a sheet of roofing material; for example, the granule-free edge on some types of mineral-surfaced roll roofing.

*Shake.* A rough-textured, usually hand-split wood shingle.

*Sheathing.* The boards or other material used to cover the rafters and provide a base for the roofing.

*Shed roof.* A roof with a single slope; also called a lean-to roof.

*Shingle.* A unit of roofing, usually wood, composition, tile, or slate.

*Shingle pattern.* The design created by offsetting the shingles a specified amount in successive courses; for example, a 4-inch (10.2-centimetre), 5-inch (12.7-centimetre), or 6-inch (15.2-centimetre) pattern. The shortened shingles used at the rakes and hips to start the pattern are called pattern pieces.

*Skylight.* An opening in the roof containing a window for light and ventilation.

*Slip sheet.* A light sheet of paper applied over the sheathing to prevent the roofing material from bonding to the sheathing.

*Slope.* The slope of a roof is commonly expressed as the number of inches of rise in 12 inches (30.5 centimetres) of run. For example, if a roof has a rise of 6 inches (15.2 centimetres) per foot, it is said to have a slope of 6 inches (15.2 centimetres) in 12 inches (30.5 centimetres), or simply 6/12. Note that a roof with a slope of 6/12 is a ¼-pitch roof. (See *Pitch.*)

*Span.* A space or distance between supports; in roof framing the width of the frame between outside edges of the building.

*Specifications.* Written information that accompanies and supplements the plans of a building.

*Split sheet.* See *Double-coverage roofing.*

*Square.* A unit of measure of roofing area equal to 100 square feet (9 square metres).

*Starter course.* The course of shingles or roll roofing that underlies the first course at the eaves.

*Tab.* The butt end of a strip shingle.

*Toe board.* A protective board fastened on a sloping roof to keep workers from slipping or falling.

*Underlayment.* An asphalt-treated felt used as a base sheet in a roofing system. (See *Base sheet.*)

*Valley.* The gutter or interior angle formed by the meeting of two roof slopes.

*Valley metal.* Sheet metal that is used in forming and weatherproofing a valley. Also called valley flashing.

*Valley sheet.* A sheet of roofing laid parallel with the valley.

*Vent.* An opening for the circulation of air; an outlet, as a vent piple.

*Vent sleeve.* See *Pipe jack.*

*Wind seal.* A factory-applied strip of asphalt cement on the face of a composition shingle. When the installed shingles are warmed by the sun, the cement strip softens and bonds the courses of shingles together for protection against the wind.

# Roofing

## Asphalt and Wood Shingling

## Tests

The following section contains objective tests for each topic of the workbook. The value of the tests depends to a great extent on the care taken by instructors and school supervisors in keeping them confidential.

Supervisors and instructors should feel free to modify the application of the workbook material and the tests to satisfy local needs. Also, the instructors will probably supplement the information in the workbook with other material that they themselves have developed, and they will need to augment the tests with questions based on any supplementary material they may use.

Instructors and supervisors should be aware that the test pages are perforated to facilitate removal of the tests, either individually or as a complete set, at the discretion of the instructor or supervisor.

# Asphalt and Wood Shingling Tests

## TOPIC 1—SHINGLING MATERIALS, TOOLS, AND EQUIPMENT

Decide which of the four answers is correct, or most nearly correct; then write the corresponding number in the blank at the right.

1. The advantages of asphalt shingles as a roofing material include: 1. ____

   1. Good fire resistance
   2. Long life
   3. Low initial cost
   4. All of the above

2. The maximum width in which wood shingles and shakes are available is: 2. ____

   1. 18 inches (45.7 centimetres)
   2. 24 inches (61 centimetres)
   3. 26 inches (66 centimetres)
   4. 30 inches (76.2 centimetres)

3. Felt underlayment commonly used under new asphalt shingles is: 3. ____

   1. No. 15 nonperforated
   2. No. 20 nonperforated
   3. No. 50 nonperforated
   4. No. 90 nonperforated

4. Which of the following types of fasteners should *not* be used with shingle roofing? 4. ____

   1. Blued steel nails
   2. Stainless-steel nails
   3. Aluminum nails
   4. Galvanized-steel nails

5. Most roofing specifications require that roofing nails be long enough to penetrate how far into the lumber sheathing? 5. ____

   1. ½ inch (1.3 centimetres)
   2. ¾ inch (1.9 centimetres)
   3. ⅞ inch (2.2 centimetres)
   4. 1 inch (2.5 centimetres)

6. Which of the following types of nails can be used satisfactorily with lead flashing? 6. ____

   1. Stainless-steel nails
   2. Plain steel nails
   3. Zinc-coated nails
   4. All of the above

7. The most common type of asphalt shingle is the: 7. ____

   1. Self-sealing square-tab strip shingle with no cutout
   2. Interlocking shingle
   3. Self-sealing random-tab strip shingle
   4. Three-tab strip shingle

8. Interwoven between courses of wood shakes are strips of: 8. ____

1. No. 25 felt
2. No. 30 felt
3. No. 40 felt
4. No. 50 felt

9. The most useful tool for a shingler is the: 9. ____

1. Pry bar
2. Tape measure
3. Roofing hatchet
4. Nail stripper

10. The advantages of roll roofing include: 10. ____

1. Low cost
2. Ease of installation
3. Suitability for use on low-slope roofs
4. All of the above

## ASPHALT AND WOOD SHINGLING TESTS

### TOPIC 2—SAFETY ON SHINGLING JOBS

Decide which of the four answers is correct, or most nearly correct; then write the corresponding number in the blank at the right.

1. The base of a 12-foot (3.7-metre) ladder should be placed how many feet out from the wall? 1. ____

   1. 1 (30.5 centimetres)
   2. 2 (61 centimetres)
   3. 3 (91.4 centimetres)
   4. 4 (121.9 centimetres)

2. The cleats on a chicken ladder should be placed approximately how far apart? 2. ____

   1. 8 inches (20.3 centimetres)
   2. 10 inches (25.4 centimetres)
   3. 12 inches (30.5 centimetres)
   4. 14 inches (35.6 centimetres)

3. When walking across a steep roof, the roofer's weight should be on: 3. ____

   1. The downhill foot
   2. The uphill foot
   3. Both feet, evenly
   4. The left foot

4. On inspections of roofs of older houses, special attention should be given to: 4. ____

   1. Eaves
   2. Cornices
   3. Canopies
   4. All of the above

5. Roof jacks should be placed no farther apart than: 5. ____

   1. 6 feet (1.8 metres)
   2. 7 feet (2.1 metres)
   3. 10 feet (3 metres)
   4. 12 feet (3.7 metres)

## ASPHALT AND WOOD SHINGLING TESTS

### TOPIC 3—PRELIMINARY WORK

Decide which of the four answers is correct, or most nearly correct; then write the corresponding number in the blank at the right.

1. An inspection of a new roof deck should include examination of: 1. ____

   1. Nailing
   2. Fit at gables and eaves
   3. Framing members supporting joints
   4. All of the above

2. On a tear-off job, the crew should start at the: 2. ____

   1. Eaves
   2. Ridge
   3. Left-hand side
   4. None of the above

3. The best place to load unopened bundles of shingles on a new roof deck or an existing roof is: 3. ____

   1. On gable overhangs
   2. At the ridge
   3. On eaves overhangs
   4. At valleys

4. The first step in planning a reroofing job with asphalt shingles or wood shingles is to: 4. ____

   1. Load the materials on the truck.
   2. Load the materials on the roof.
   3. Inspect the deck.
   4. Determine whether partial or complete tear-off is required.

5. Holes discovered during the inspection of a new roof deck should be: 5. ____

   1. Covered with sheet metal
   2. Disregarded
   3. Filled with plastic cement
   4. Covered with a patch of No. 90 felt

## ASPHALT AND WOOD SHINGLING TESTS

### TOPIC 4—APPLICATION OF ASPHALT SHINGLES IN NEW CONSTRUCTION

Decide which of the four answers is correct, or most nearly correct; then write the corresponding number in the blank at the right.

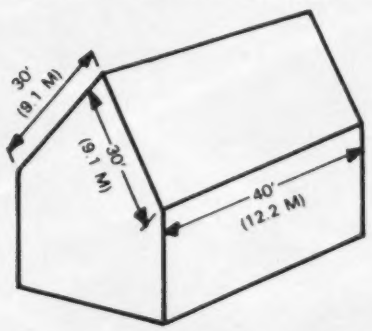
1. For best adhesion seal-tab shingles should be installed when the temperature is at least: 1. _____

   1. 50° F. (10° C)
   2. 65° F. (18.3° C)
   3. 70° F. (21.1° C)
   4. 80° F. (26.7° C)

2. Shingles installed over an insulated deck are susceptible to: 2. _____

   1. Deterioration from heat buildup
   2. Wind damage
   3. Damage from accumulated snow
   4. None of the above

3. What is the area of the roof shown below? 3. _____




   1. 100 square feet (9.3 square metres)
   2. 200 square feet (18.6 square metres)
   3. 1,200 square feet (115. square metres)
   4. 2,400 square feet (223 square metres)

4. Which of the following would be the best underlayment to use with a shingle roof on a new deck? 4. _____

   1. No. 15 asphalt-saturated nonperforated felt
   2. No. 15 coated nonperforated felt
   3. No. 30 tar-saturated nonperforated felt
   4. No. 30 coated nonperforated felt

5. In flashing a valley, the roofer should be sure that the horizontal courses of felt underlayment overlap the flashing by at least: 5. _____

   1. 3 inches (7.6 centimetres)
   2. 6 inches (15.2 centimetres)
   3. 8 inches (20.3 centimetres)
   4. 10 inches (25.4 centimetres)

6. Open valleys are usually flashed with: 6. ____

1. No. 50 smooth-surfaced roll roofing
2. No. 50 mineral-surfaced roll roofing
3. No. 90 smooth-surfaced roll roofing
4. No. 90 mineral-surfaced roll roofing

7. If standard shingles are being applied with a 6-inch offset, the fourth course will begin with a shingle that is how wide? 7. ____

1. 36 inches (91.4 centimetres)
2. 30 inches (76.2 centimetres)
3. 18 inches (45.7 centimetres)
4. 12 inches (30.5 centimetres)

8. Careful alignment of the first course of shingles is most important to ensure: 8. ____

1. The proper exposure of the shingles
2. Good appearance
3. Watertightness
4. Compliance with local codes

9. Which of the following statements about metric shingles is (are) true? 9. ____

1. Nailing patterns are the same as those used for standard shingles.
2. They are applied with greater exposure to weather.
3. Fewer shingles and nails are required to cover a given roof area than with standard shingles.
4. All of the above.

10. Ridge shingles should be applied with an exposure of: 10. ____

1. 5 inches (12.7 centimetres)
2. 6 inches (15.2 centimetres)
3. 7 inches (17.8 centimetres)
4. 9 inches (22.9 centimetres)

11. A section of roof must be flashed where it meets a vertical wall. If metal flashing shingles are to be used with strip shingles having a 6-inch (15.2-centimetre) exposure, how wide should the flashing shingles be cut? 11. ____

1. 6 inches (15.2 centimetres)
2. 7 inches (17.8 centimetres)
3. 8 inches (20.3 centimetres)
4. 10 inches (25.4 centimetres)

12. Which of the following should be installed first in flashing a chimney? 12. ____

1. The cricket
2. The underlayment
3. The apron flashing
4. The step flashing

13. Under normal conditions three-tab strip shingles require how many fasteners each? 13. ____

1. 2
2. 3
3. 4
4. 6

14. If a fastener placed in a shingle does not appear to have a sound bearing, the roofer should: 14. ____

    1. Leave it, and place another fastener nearby.
    2. Remove it, and drive another fastener nearby.
    3. Leave it, and just use one less fastener than is recommended.
    4. Remove it, fill the hole with plastic cement, and drive another fastener nearby.

15. On a roof surface that has no valleys, dormers, or other interruptions in the surface, shingling should begin: 15. ____

    1. At the left rake
    2. At the rake that is most visible
    3. At the right rake
    4. At the rake closest to west

## ASPHALT AND WOOD SHINGLING TESTS

### TOPIC 5—REROOFING WITH ASPHALT SHINGLES

Decide which of the four answers is correct, or most nearly correct; then write the corresponding number in the blank at the right.

1. Edging strips should overhang the roof deck by about: 1. ____

   1. ½ inch (1.3 centimetres)
   2. ¾ inch (1.9 centimetres)
   3. 1 inch (2.5 centimetres)
   4. 1¼ inches (3.2 centimetres)

2. The most common roof slope is: 2. ____

   1. 1/12
   2. 3/12
   3. 4/12
   4. 6/12

3. Most residential reroofing work involves: 3. ____

   1. Three-tab strip shingles
   2. Roll roofing
   3. Wood shakes
   4. Large individual shingles

4. Trimmed strip shingles used in the starter course on a recover job over an existing shingle roof should be: 4. ____

   1. Six inches (15.2 centimetres) wide
   2. The same width as the shingles on the existing roof
   3. The width of the shingle exposure on the old roof
   4. None of the above

5. In areas subject to heavy winds, how many nails are recommended for applying strip shingles? 5. ____

   1. 4
   2. 6
   3. 7
   4. 8

6. If an existing asphalt-shingle roof is to be reshingled, and the existing roof has a smooth open valley, the valley should be built up flush with the shingles with: 6. ____

   1. No. 90 felt
   2. No. 90 mineral-surfaced roll roofing
   3. No. 90 smooth-surfaced roll roofing
   4. Any of the above

7. Old flashings that must be removed: 7. ____

   1. Should be discarded immediately
   2. Should be bent into small pieces before being discarded
   3. Can be used as patterns to cut new flashings
   4. Should be removed in whatever way possible, regardless of the amount of damage to them

8. Felt underlayment may be omitted over an existing roof if the roof slope is no less than: 8. _____

   1. 8/12
   2. 6/12
   3. 4/12
   4. 3/12

9. Edge reinforcement is especially important where the roof will be subjected to: 9. _____

   1. High winds
   2. Heavy rains
   3. Heavy snows
   4. Salt air

10. Damaged areas in old roll roofing should be repaired with a patch that is applied with: 10. _____

   1. Nails
   2. Hot asphalt
   3. Plastic cement
   4. Coal-tar pitch

## ASPHALT AND WOOD SHINGLING TESTS

### TOPIC 6—APPLICATION OF ROLL ROOFING

Decide which of the four answers is correct, or most nearly correct; then write the corresponding number in the blank at the right.

1. Which of the following would be an appropriate side overlap between layers of single-coverage roll roofing applied parallel to the eaves? 1. ____

   1. 2 inches (5.1 centimetres)
   2. 4 inches (10.2 centimetres)
   3. 5 inches (12.7 centimetres)
   4. 6 inches (15.2 centimetres)

2. Double-coverage roll roofing is applied with a side overlap of: 2. ____

   1. 15 inches (38.1 centimetres)
   2. 17 inches (43.2 centimetres)
   3. 19 inches (48.3 centimetres)
   4. 21 inches (53.3 centimetres)

3. Single-coverage roll roofing may be applied with exposed nailing provided that the slope of the roof is no less than: 3. ____

   1. 1/2/12
   2. 1/12
   3. 2/12
   4. 4/12

4. Generally, roll roofing should not be applied unless the temperature is at least: 4. ____

   1. 38° F. (3.3° C)
   2. 45° F. (7.2° C)
   3. 55° F. (12.8° C)
   4. 65° F. (18.3° C)

5. The first course of roll roofing should be applied so that it overhangs the eaves and rakes by at least ¼ inch (0.6 centimetres) but not more than: 5. ____

   1. 1 inch (2.5 centimetres)
   2. ¾ inch (1.9 centimetres)
   3. ½ inch (1.3 centimetres)
   4. ⅜ inch (1 centimetre)

6. Concealed nails used to apply single-coverage roll roofing to a hip or ridge should be spaced how many inches on centers? 6. ____

   1. 2 (5.1 centimetres)
   2. 3 (7.6 centimetres)
   3. 4 (10.2 centimetres)
   4. 6 (15.2 centimetres)

7. When exposed nails are used to attach single-coverage roll roofing parallel to the rakes, the nails should be placed how far in from the edge of the roof? 7. ____

   1. 1 inch (2.5 centimetres)
   2. 1½ inches (3.8 centimetres)
   3. 1¾ inches (4.4 centimetres)
   4. 2 inches (5.1 centimetres)

8. Which of the following statements is (are) true about double-coverage application of roll roofing parallel to the eaves? 8. ____

   1. The application can be used on roofs with slopes as low as 1/12.
   2. The double coverage is achieved by overlapping the strips more than half their width.
   3. No portion of the roof is covered by less than two layers of roofing.
   4. All of the above.

9. For which of the following would hot-mopped asphalt be used to seal the horizontal and vertical laps in roll roofing? 9. ____

1. Single-coverage application parallel to the rakes
2. Single-coverage application parallel to the eaves
3. Double-coverage application parallel to the eaves
4. None of the above

10. If more than one piece of roll roofing is needed to complete a course when single-coverage roll roofing is being applied parallel to the eaves, the overlap between the ends of the pieces should be: 10. ____

1. 2 inches (5.1 centimetres)
2. 4 inches (10.2 centimetres)
3. 6 inches (15.2 centimetres)
4. None of the above

## ASPHALT AND WOOD SHINGLING TESTS

### TOPIC 7—APPLICATION OF WOOD SHINGLES AND SHAKES

Decide which of the four answers is correct, or most nearly correct; then write the corresponding number in the blank at the right.

1. If a deck with open sheathing is to be covered with wood shingles, the sheathing boards should be 1 x 4 (2.5 x 10.2 centimetre) lumber spaced no further apart than: 1. ____

   1. 6 inches (15.2 centimetres)
   2. 5 inches (12.7 centimetres)
   3. 4 inches (10.2 centimetres)
   4. 3½ inches (8.9 centimetres)

2. Wood-shake and wood-shingle hip and ridge units are attached with which size nail? 2. ____

   1. 3d
   2. 6d
   3. 7d
   4. 8d

3. How many nails should be used to attach wood shingles? 3. ____

   1. 2
   2. 3
   3. 4
   4. 6

4. In the application of wood shingles, the shingle joints should be staggered at least: 4. ____

   1. 1¼ inches (3.2 centimetres)
   2. 1½ inches (3.8 centimetres)
   3. 1¾ inches (4.4 centimetres)
   4. 2 inches (5.1 centimetres)

5. Flashing used with wood shingles and shakes should be corrosion-resistant metal of at least: 5. ____

   1. No. 16 gage
   2. No. 20 gage
   3. No. 26 gage
   4. No. 30 gage

6. Valley-flashing metal should extend at least 8 inches (20.3 centimetres) each way from the valley centerline for wood shingles. How far from the centerline should it extend for wood shakes? 6. ____

   1. 11 inches (27.9 centimetres)
   2. 9 inches (22.9 centimetres)
   3. 8 inches (20.3 centimetres)
   4. 6 inches (15.2 centimetres)

7. If wood shakes are to be applied over solid sheathing in an area subject to wind-driven snows, the sheathing should generally be covered with underlayment of what number? 7. ____

   1. 15
   2. 30
   3. 45
   4. 50

8. The maximum weather exposure recommended for 24-inch (61-centimetre) shakes is 10 inches (25.4 centimetres). For 18-inch (45.7-centimetre) shakes, the recommended exposure is: 8. ____

1. 10 inches (25.4 centimetres)
2. 8½ inches (21.6 centimetres)
3. 8 inches (20.3 centimetres)
4. 7½ inches (19.1 centimetres)

9. Hip and ridge wood-shingle cover units should be applied with: 9. ____

1. Three nails each
2. Plastic cement
3. Exposed nails
4. Concealed nails

10. Wood shingles wider than how many inches should be split and nailed as two shingles? 10. ____

1. 4 inches (10.2 centimetres)
2. 6 inches (15.2 centimetres)
3. 7 inches (17.8 centimetres)
4. 8 inches (20.3 centimetres)



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